



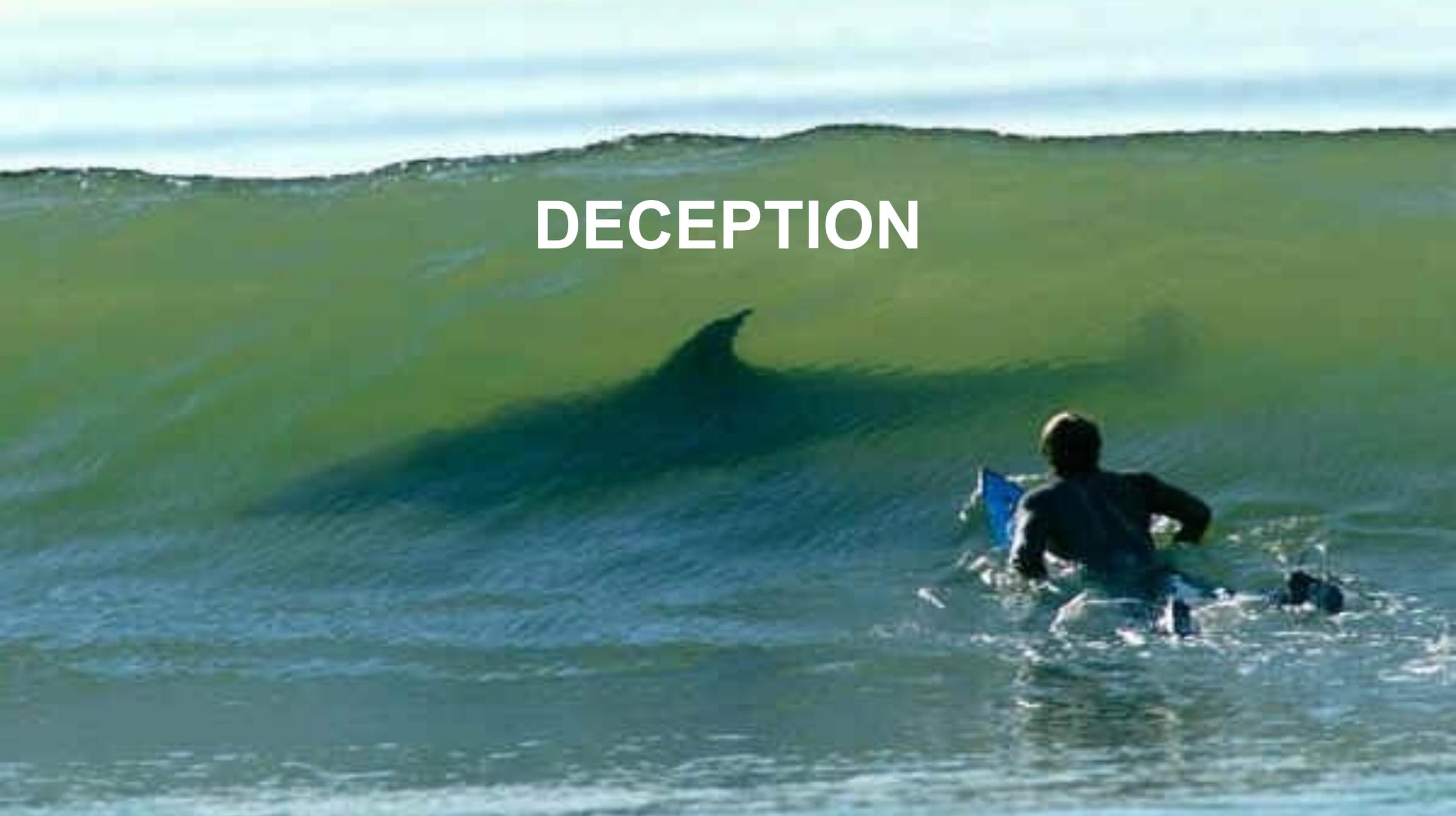
Geriatric Trauma: Navigating the Uncharted Sea



Bellal Joseph, MD, FACS
Professor & Chief of Trauma and Acute Care Surgery
The University of Arizona, Tucson, AZ



DECEPTION





Nothing to Disclose



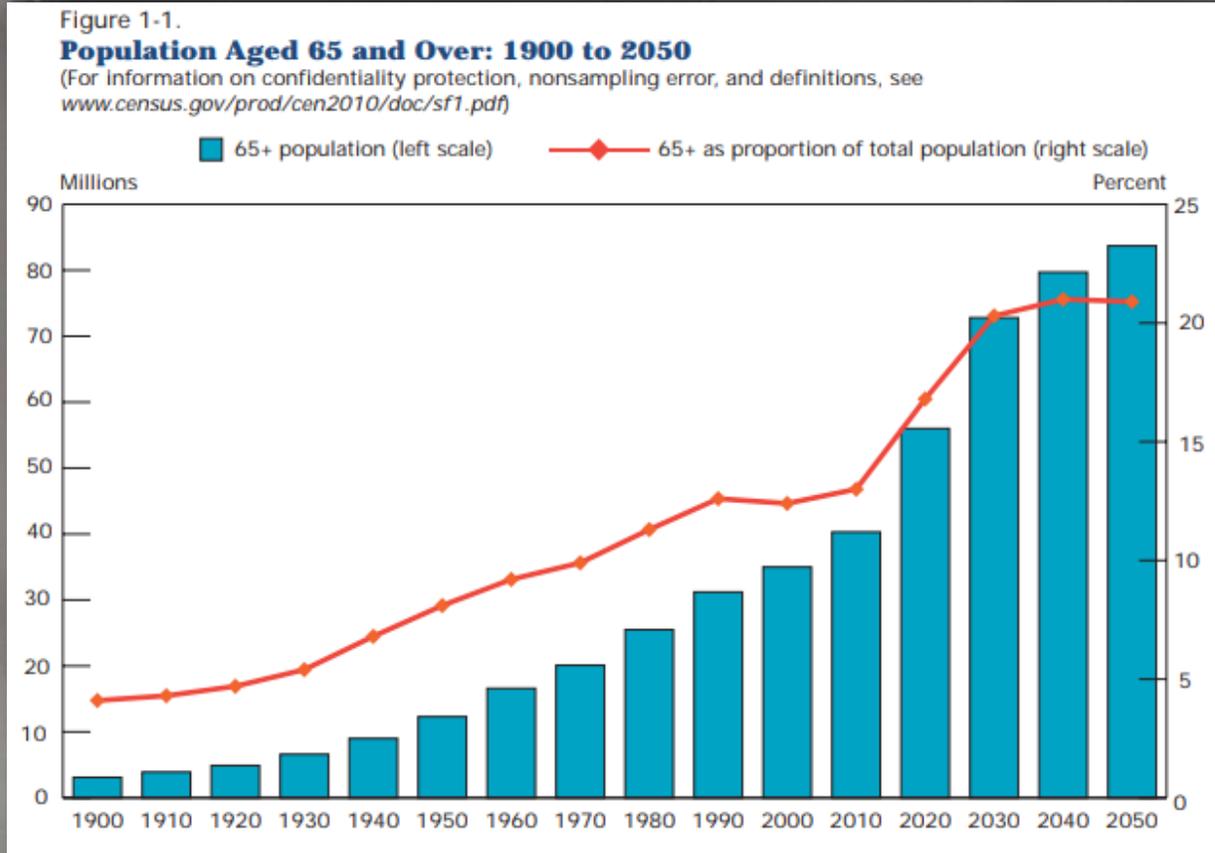
Why Are We Here?

Geriatric Trauma
Frailty
Under/Overtriage
Futility of Resuscitation
COVID-19 and the Elderly



An Aging Nation

Elderly  Fastest Growing Population



An Aging Nation

Aging population to hit U.S. economy like a 'ton of bricks' –
 U.S. Secretary of Commerce (July 2021)

Geriatric Trauma



- Trauma is the **seventh leading cause of death in the elderly**

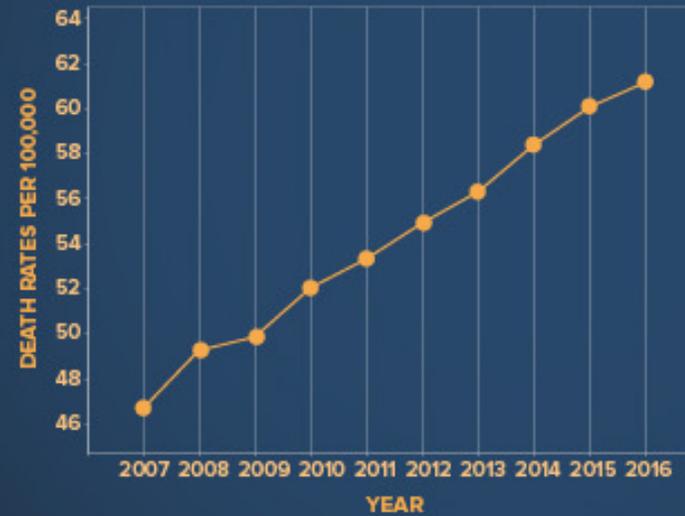
- Geriatric Trauma Patients:

↑ In Absolute Number & Proportion



Ongoing Epidemic of Geriatric Trauma

Fall Death Rates in the U.S.
INCREASED 30%
FROM 2007 TO 2016 FOR OLDER ADULTS



If rates continue to rise,
we can anticipate

**7 FALL
DEATHS**
EVERY HOUR
BY 2030

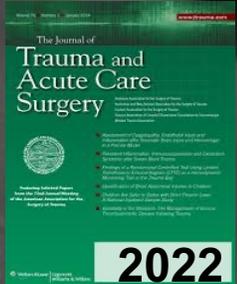
Learn more at www.cdc.gov/HomeandRecreationalSafety.



Healthcare Burden

The public health burden of geriatric trauma: Analysis of 2,688,008 hospitalizations from Centers for Medicare and Medicaid Services inpatient claims

Fakhry, Samir M. MD, FACS; Shen, Yan PhD; Biswas, Saptarshi MD; Duane, Therese M. MD; McBride, Katherine M. MD, et al.



- **2016-2019 Medicare and Medicaid** Standard Analytical Files

Trauma Center Level	Total Hospitalizations N (%)	Expenditure (Billion \$)
Level I	569,661 (21.2%)	\$9.3
Level II	617,780 (23.0%)	\$7.3
Level III	382,889 (14.2%)	\$4.2
Level IV	104,361 (3.9%)	\$1.1
Non-Trauma Centers	1,113,317 (37.7%)	\$11.1

Trauma-related hospitalizations:

- Total expenditures  \$33 billion
- Non-Trauma Centers  Vital role

Most common diagnoses:

- Hip/femur fractures (1/4)**



Older Adults in Georgia



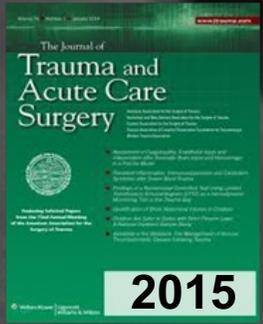
- **1 in 5** residents in **GA** → ≥ 60 years
- **32% of TC admissions** in 2020 were ≥ 65 years

Older Adults in Georgia



An analysis of the effectiveness of a state trauma system
Treatment at **designated trauma centers (DTC)** is associated with
an increased probability of survival

Ashley, Dennis W. MD; Pracht, Etienne E. PhD; Medeiros, Regina S. DNP, RN; et al



63% of severely injured trauma patients managed at
nontrauma centers were **> 65 yrs old**

• Cohort: **13,953** severely injured trauma patients (DTC 10,386; **NTC 3,547**)

• **DTC** → **10%** ↑ probability of survival



Focus On Isolated Head Injury Underscores

Need For Protocolized Geriatric Traumatic Brain Injury Care

E Mlaver, J Codner, G Solomon, SR Todd, ER Benjamin

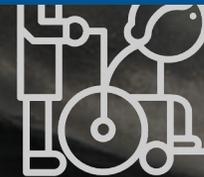


2023

- Georgia Quality Improvement Program 2019 - 2021
- Aim: Identify potential areas for pt-centered protocols for Isolated TBI pts

?

of previously functionally independent geriatric pts required post-discharge services



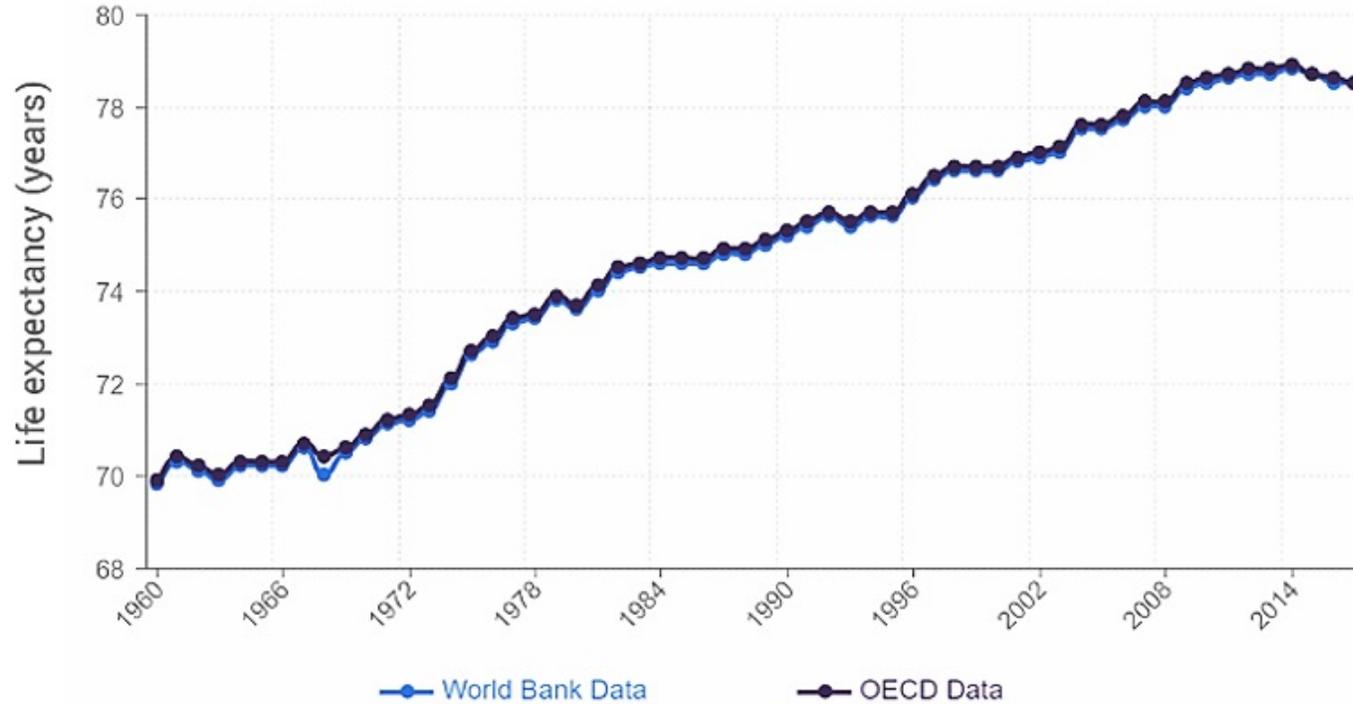
?

?

?

Elderly are Living More **Active Lifestyles**

United States life expectancy at birth
(1960-2017) Average age for male and female



What is the Definition of Old Age?



Inconsistent Definitions of Age, Trauma, and Complications



Trauma Surgery

Expectations



Trauma Surgery

Reality





WHY do we CARE?



Trauma

Extrication

Traumatic brain
injury

Transfusion vasopressors

FAST

GCS

Protocol

Burns

Injury severity score

Intubation

Falls

Cardiac
Arrest

Gunshot wounds

Splenic laceration

Geriatric Trauma

Dementia

Transfusion

Incontinence

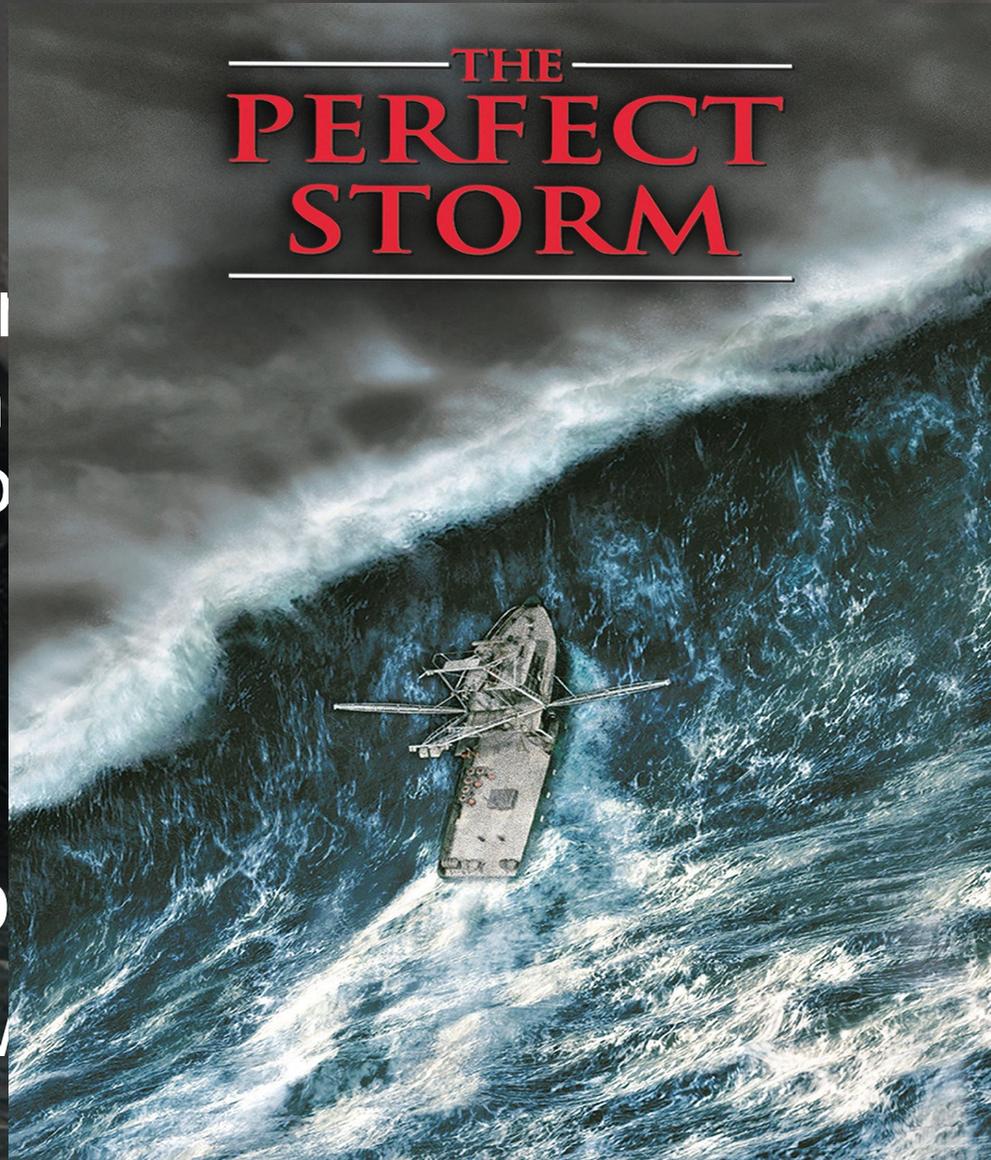
Pro

Functional decline

Falls

Morb

Gunshot v



anxiety

atic brain

njury

GCS

on's

everity score

Cardiac

Arrest

se

enic laceration

A blurred photograph of a hospital hallway. Several people, likely medical staff, are walking in the hallway. The scene is dimly lit with overhead fluorescent lights. The overall tone is blue and teal. A semi-transparent teal banner is overlaid across the middle of the image, containing the title text.

Older Adult Patients Do Worse After Trauma

Original Investigation

ONLINE ONLY

FREE

July 10, 2019

Comparison of Injured Older Adults Included in vs Excluded From Trauma Registries With 1-Year Follow-up

Craig D. Newgard, MD, MPH¹; Aaron Caughey, MD, PhD²; K. John McConnell, PhD^{1,3}; [et al](#)

» [Author Affiliations](#) | [Article Information](#)

JAMA Surg. 2019;154(9):e192279. doi:10.1001/jamasurg.2019.2279



Editorial
Comment



Related
Articles

Invited Commentary

ONLINE ONLY

July 10, 2019

The True Outcomes of Geriatric Trauma—If We Do Not Count Them, We Will Never Know

Vanessa P. Ho, MD, MPH¹; Lisa Reider, PhD²; Elliott R. Haut, MD, PhD^{2,3,4,5,6}

Older adults account for more than 30% of trauma admissions in the United States, and as Americans live longer, this number will continue to grow.¹ In response, the trauma community has increased research and programmatic efforts toward improving care and outcomes of older trauma patients.^{2,3} For trauma surgeons and systems, the trauma registry is the foundational data source for measurement, quality improvement, and research. These trusted registries are used to identify gaps in care and track process improvements. In this issue of *JAMA Surgery*, a study by Newgard et al⁴ beautifully demonstrates that nearly 3 in 4 older patients were left out of a sample of trauma registries. This article also reiterates the National Academies of Science, Engineering, and Medicine's emphasis of long-term follow-up after trauma⁵ more than 80% of deaths within 1 year occurred in patients who were not included in the trauma registry. These data show that the current registry approach vastly underestimates the magnitude and overall burden of geriatric trauma.

Poor Outcomes Despite “Innocent” Mechanism



Cost of Care



Hospital Length of Stay



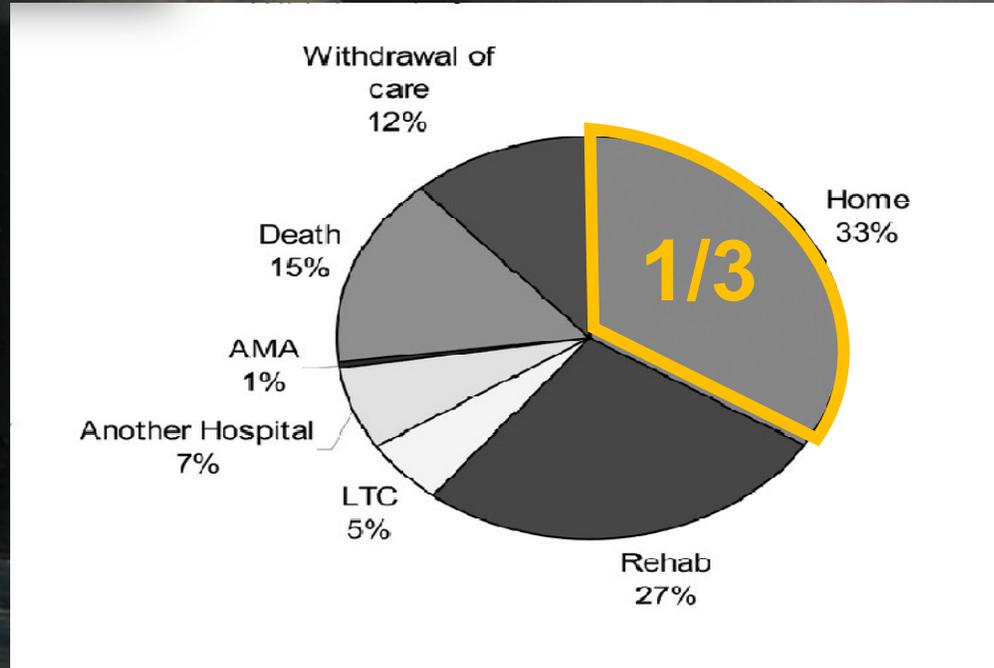
In-hospital Mortality



Discharge to rehab/SNF

Complication rate and case mortality rate by type of complication and age group

Type	Age (years)			
	≥65		<65	
	Complication Rate	Mortality Rate	Complication Rate	Mortality Rate
Pulmonary	21.7%	28.2%	12.1%	11.3%
Infectious	16.7%	26.7%	9.6%	7.0%
Cardiovascular	12.2%	18.2%	2.9%	20.5%
Renal	3.9%	71.4%	0.8%	33.0%
Others	18.3%	30.3%	11.9%	15.7%



Complication Rates

1. Urological Complications – 27.2%



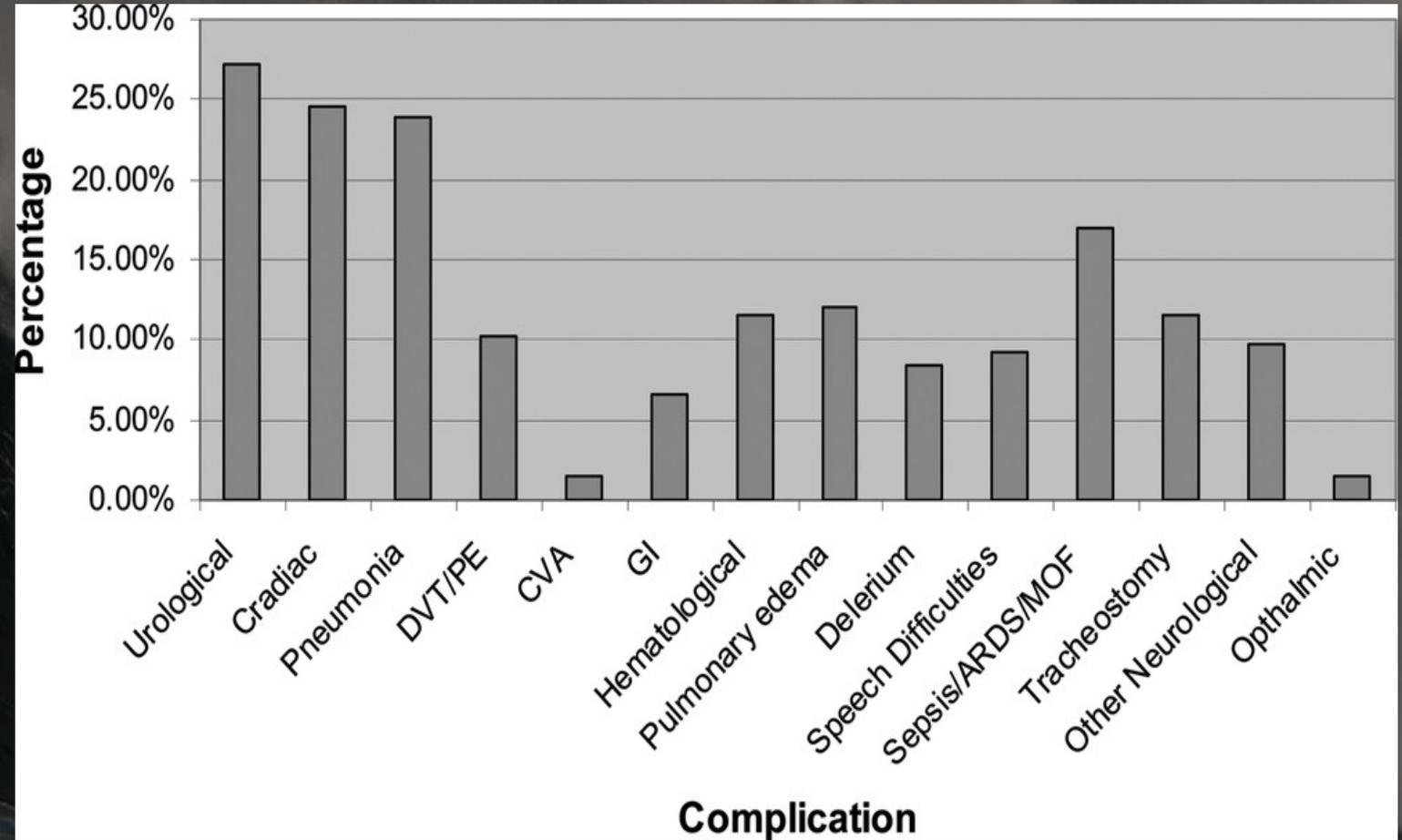
2. Cardiac Complications – 24.6%



3. Pneumonia – 23.9%



4. DVTs, PEs – 12%



Is it Us or the Patients?



Elderly Pts Do Worse After Trauma

Patient-Related Factors



- Aging
- Frailty
- Comorbidities
- Malnutrition
- Polypharmacy
- Anti-coagulants



Hospital/System Related Factors



- Triage, Trauma Activation
- Multidisciplinary Care
- Hospital/ Surgeon Volume
- Geriatric Trauma Centers



The Evils of Geriatric Trauma

Comorbidities

Aging

Frailty

Anticoagulants

Polypharmacy

Aging Matters



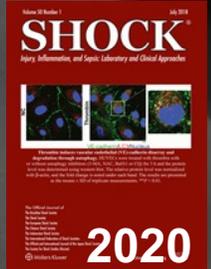
AGE



Aging

The Consequences of Aging On the Response to Injury and Critical Illness

Joseph, Bellal; Scalea, Thomas



Older Age and Organ System Changes

↓
Neuro-
Cognition

Injuries lead to devastating outcomes in older adults

↓
Nutrition
Absorption

↓
Sarcopenia

Predictors of mortality in geriatric trauma patients: A systematic review and meta-analysis

Hashmi, Ammar MD; Ibrahim-Zada, Irada MD, PhD; Rhee, Peter MD; Aziz, Hassan MD; Fain, Mindy J. MD; Friese, Randall S. MD; Joseph, Bellal MD



- Utilized **MEDLINE, PubMed, and Web of Science** databases
- Included studies on geriatric mortality and injury severity
- **Outcomes:**
 - Mortality according to age groups (65–74, 75–84, & ≥ 85 yrs)

Aging



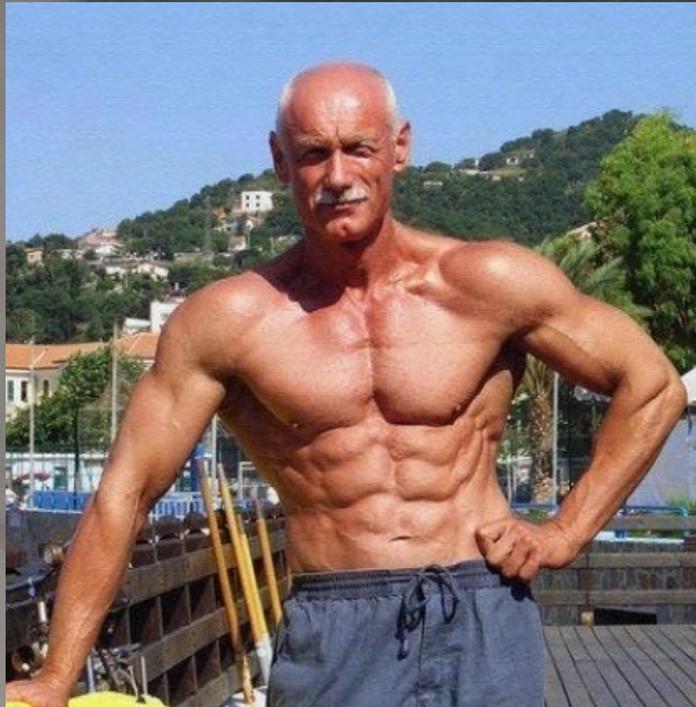
The Odds of Dying Do Not Change Significantly After **Age 74 Years**



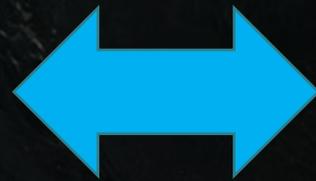
Where Do We Draw the Line?

Age vs. Physiologic Reserve

Why Should We Distinguish Geriatric Patients?



Same Age



Age is just a number...

Is it Age or Frailty?



Frailty





Which life are you designing?

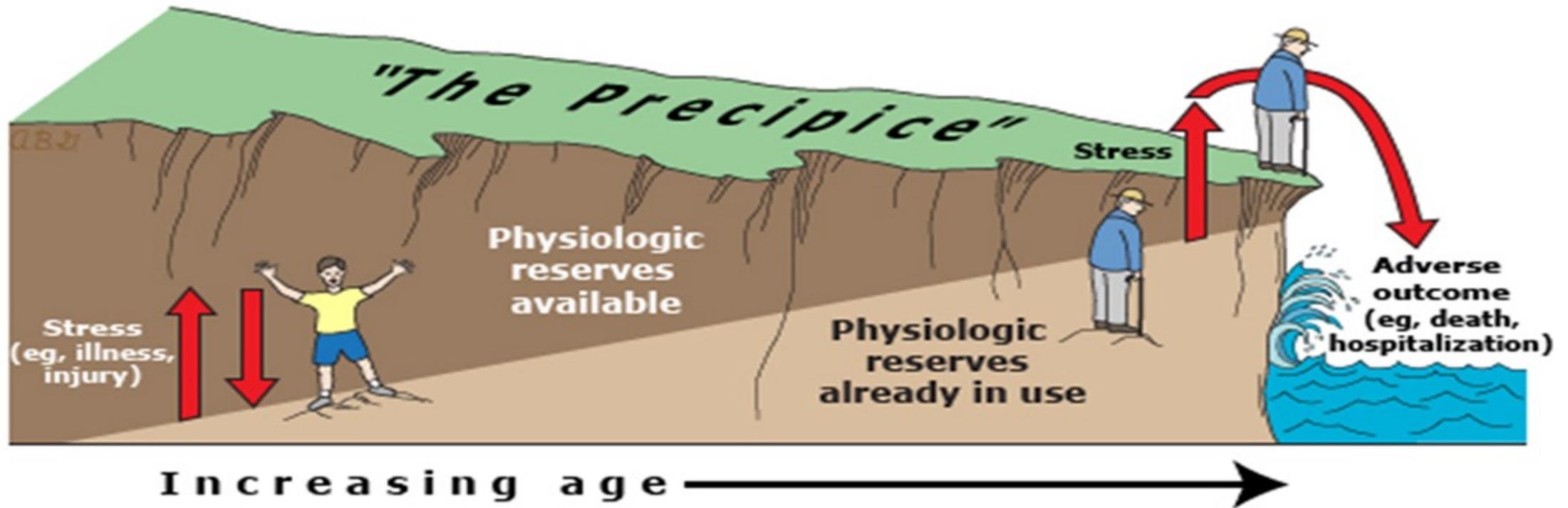
A Syndrome Of Physiological Decline That Affects All Organ Systems

- Age-associated decline in physiologic reserve and function
- State of increased vulnerability
- Independent of:
 - Age
 - Functional disability



Frailty

Both Age & Frailty Push Patients Over the Cliff's Edge



Frailty



Non-Frail



Frail



Aging vs. Frailty

Extensive Comorbidities

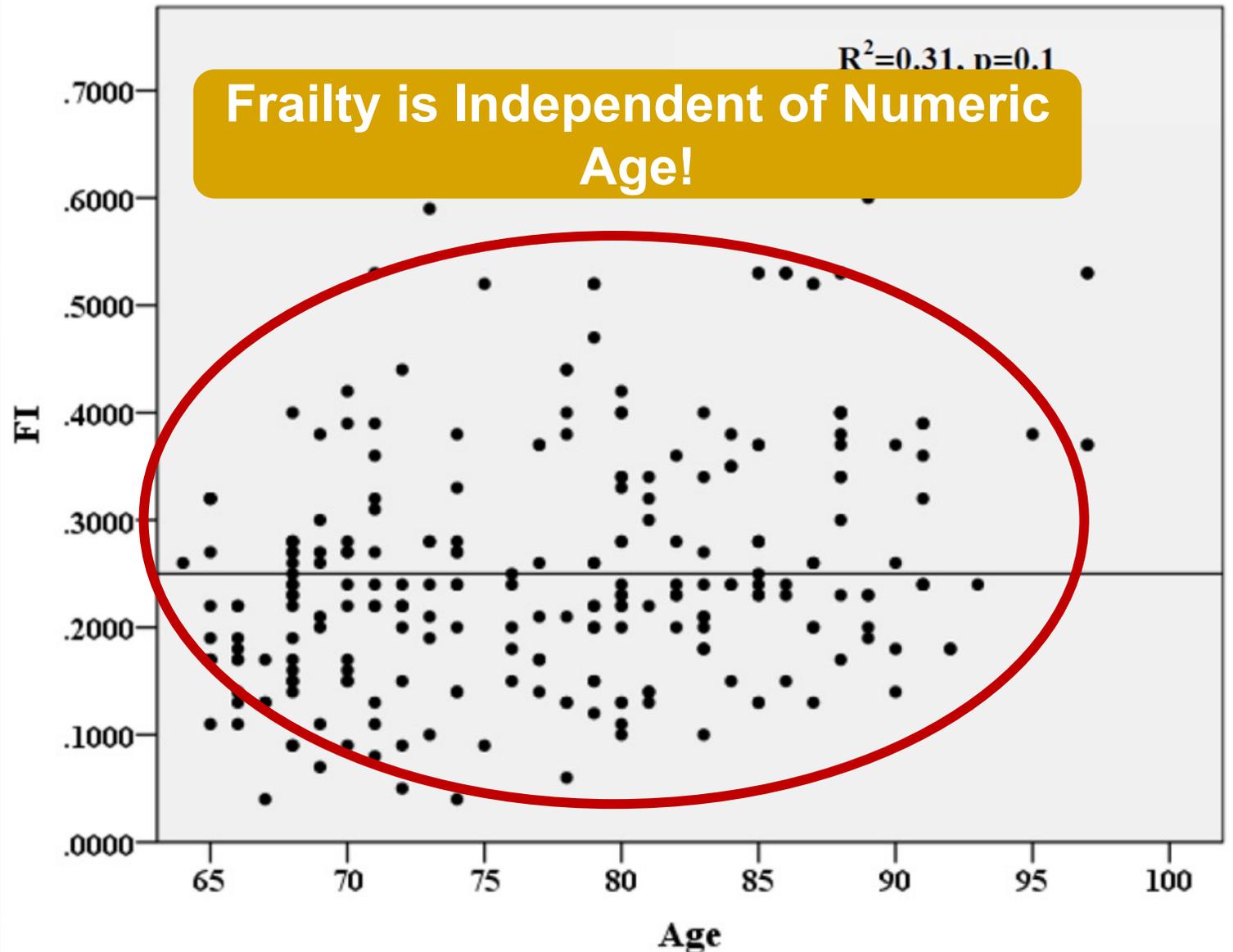
Cognitive Impairment

Social Isolation

Physical Function
Impairment

Sedentary Behavior

Weight Loss



Frailty Models

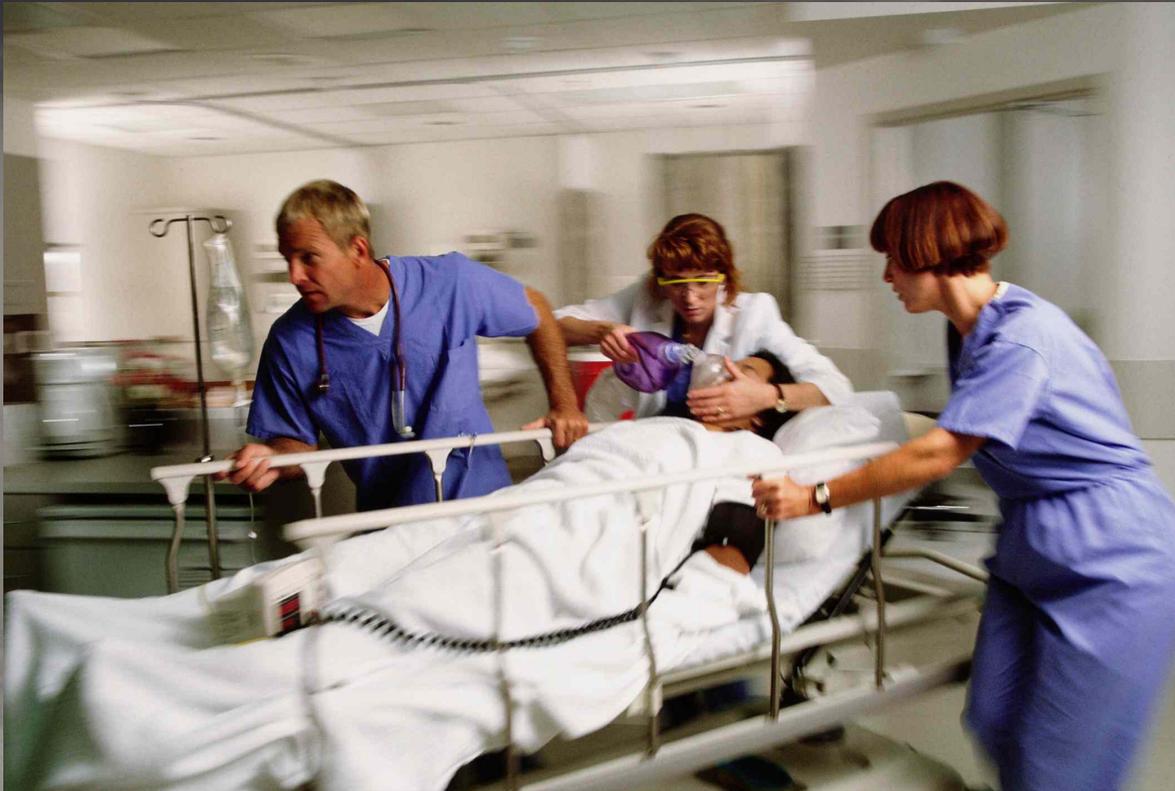
Conceptualizing and Measuring frailty

- **Phenotypic Model:** Frailty as a **biologic syndrome** of decreased reserves

CSHA-FI is Composed of 50 Variables!



Feasible in Trauma Patients?



We Developed Our Own FI



Validating **Trauma-Specific Frailty Index** for Geriatric Trauma Patients: A Prospective Analysis

Bellal Joseph, MD, Viraj Pandit, MD, Bardiya Zangbar, MD, Narong Kulvatunyou, MD, Andrew Tang, MD, Terence O'Keeffe, MD, Donald J. Green, MD, Gary Vercruysse, MD, Mindy J. Fain, MD, Randall S. Friese, MD, and Peter Rhee, MD



- 2-year prospective cohort study
- 250 geriatric trauma patients: **Frail vs Non-frail**
- TSFI: 15 variable FI

Measuring Frailty



Fifteen Variable Trauma Specific Frailty Index

Comorbidities

Cancer history	YES (1)	No (0)	
Coronary Heart Disease	MI (1)	CABG (0.75)	PCI (0.5)
Dementia			

Daily Activities

- Help with grooming
- Help managing money
- Help doing housework
- Help toileting
- Help walking

Health Attitude

- Feel less useful
- Feel sad
- Feel effort to do everything
- Falls
- Feel lonely

Function

Sexually active	Yes (0)	No (1)
-----------------	---------	--------

Nutrition

Albumin	<3 (1)	>3 (0)
---------	--------	--------

TSFI = The total score obtained from the questionnaire is divided by 15
 Non-frail = TSFI ≤ 0.12; Prefrail = TSFI 0.12 to 0.25; Frail = TSFI > 0.25

• 15 most predictive variables

predictive abilities



THE BLADE

One of America's Great Newspapers



Age appropriate: Intimacy need not be a casualty of growing older

“A 2018 survey conducted by the University of Michigan found that approximately **40%** of people between the ages of 65 and 80 **remain sexually active**”.

Frailty & Outcomes

Frail



Non-Frail





**Failure- to- Rescue
(x3)**



In-hospital Mortality (x3)

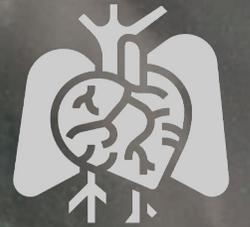


**Health-related QoL
(x0.5)**

**10 Years
in 30 Seconds**



**Hospital
LOS (x3)**



**Cardiac/Respiratory
Complications (x3)**



**Discharge to
rehab/SNF (x5)**

Frail vs. Non-Frail



**Infectious
Complications (x2.5)**

What about the Post-Discharge Outcomes?



**HOW LONG IS
THIS GOING TO LAST?**

Post-Discharge Outcomes



**30-Day
Readmission**



**30-day Emergency
Hospital Readmission
(x1.5)**

**30- day Readmission
Mortality
(x2)**

**6-Month
Outcomes**



**Trauma
Readmission
(↑ 40%)**

**Repeat
Falls
(↑ 60%)**

**6-months
Mortality
(↑ 10%)**

**Functional
Recovery
Outcomes**



**Admission
FIM**

**Discharge
FIM**

**Delta
FIM**

Need more proof?



TSFI Multicenter Validation



Prospective Validation and Application of the Trauma Specific Frailty Index (TSFI): Results of An AAST MIT

Bellal Joseph, MD, Abdul Tawab Saljuqi, MD, Joseph D. Amos, MD, Amanda Teichman, MD, Melissa L. Whitmill, MD, Tanya Anand, MD, Hamidreza Hosseinpour, MD, Sigrid K. Burruss, MD, Julie A. Dunn, MD, Kaveh Najafi, DO, Laura N. Godat, MD, Toby M. Enniss, MD, Thomas H. Shoultz, MD, Tanya Egodage, MD, Tasce Bongiovanni, MD, Joshua P. Hazelton, DO, Kristin P. Colling, MD, Todd W. Costantini, MD, Deborah M. Stein, MD, Thomas J. Schroepel, MD, Jeffry Nahmias MD, and the AAST Frailty MIT Study Group

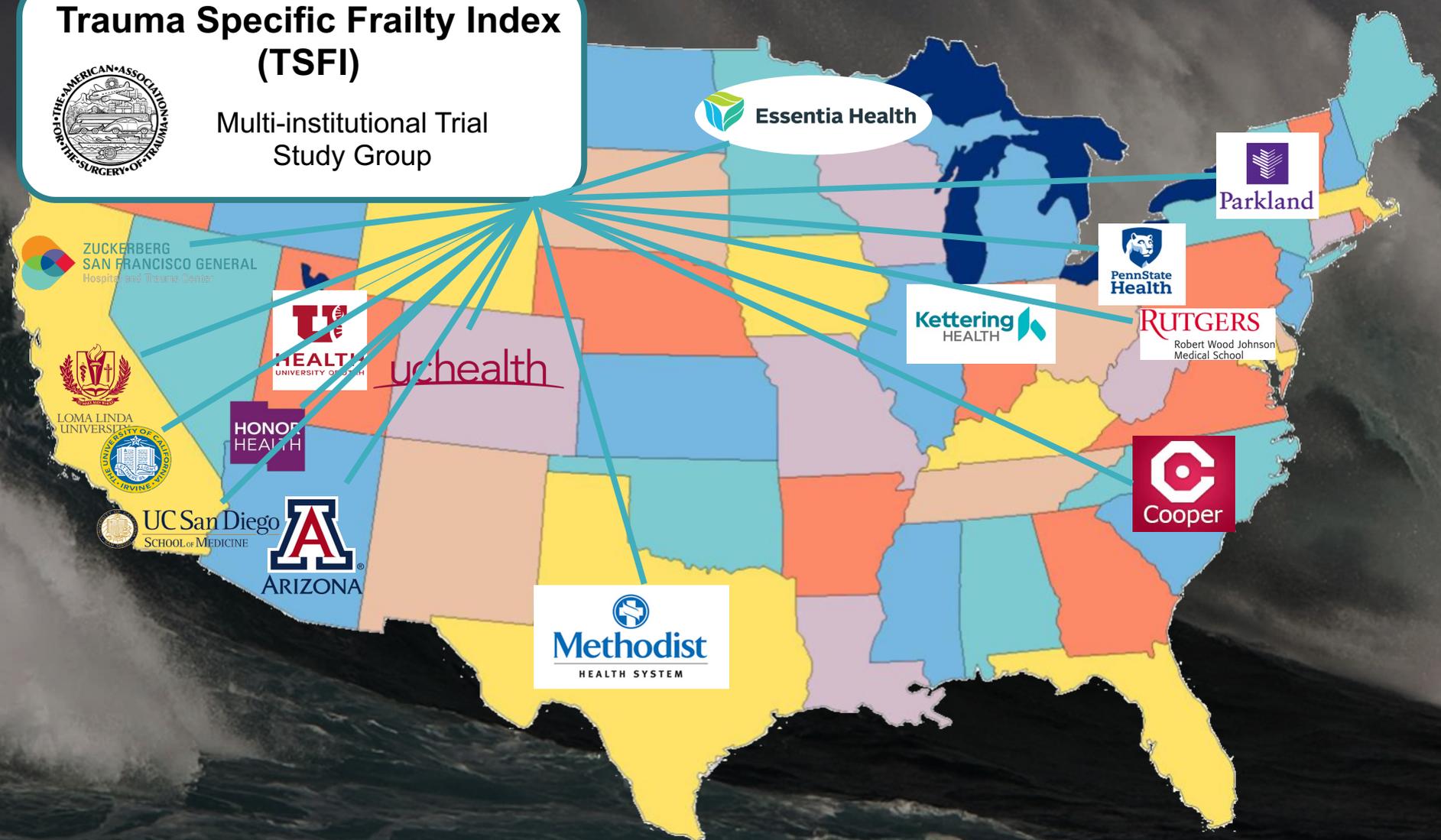


- Prospective **three-year (2019-2022)** multicenter cohort study
- **1,321** prospectively enrolled patients at **17 Level I and Level II trauma centers**
- Aim: Prospectively validate the TSFI at a multi-institutional level
- Outcomes: **Index admission & 3-month post-discharge**

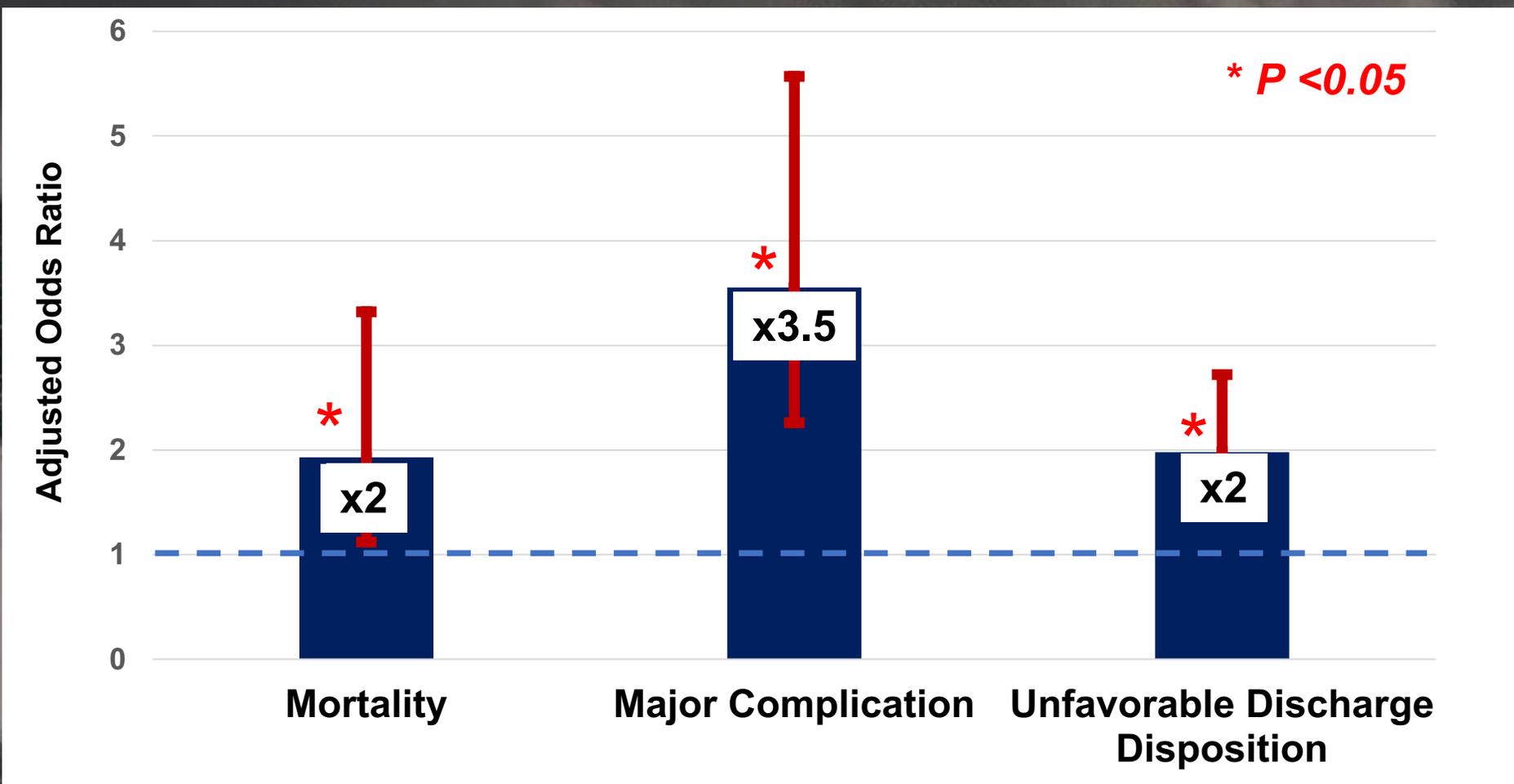
TSFI Multicenter Validation



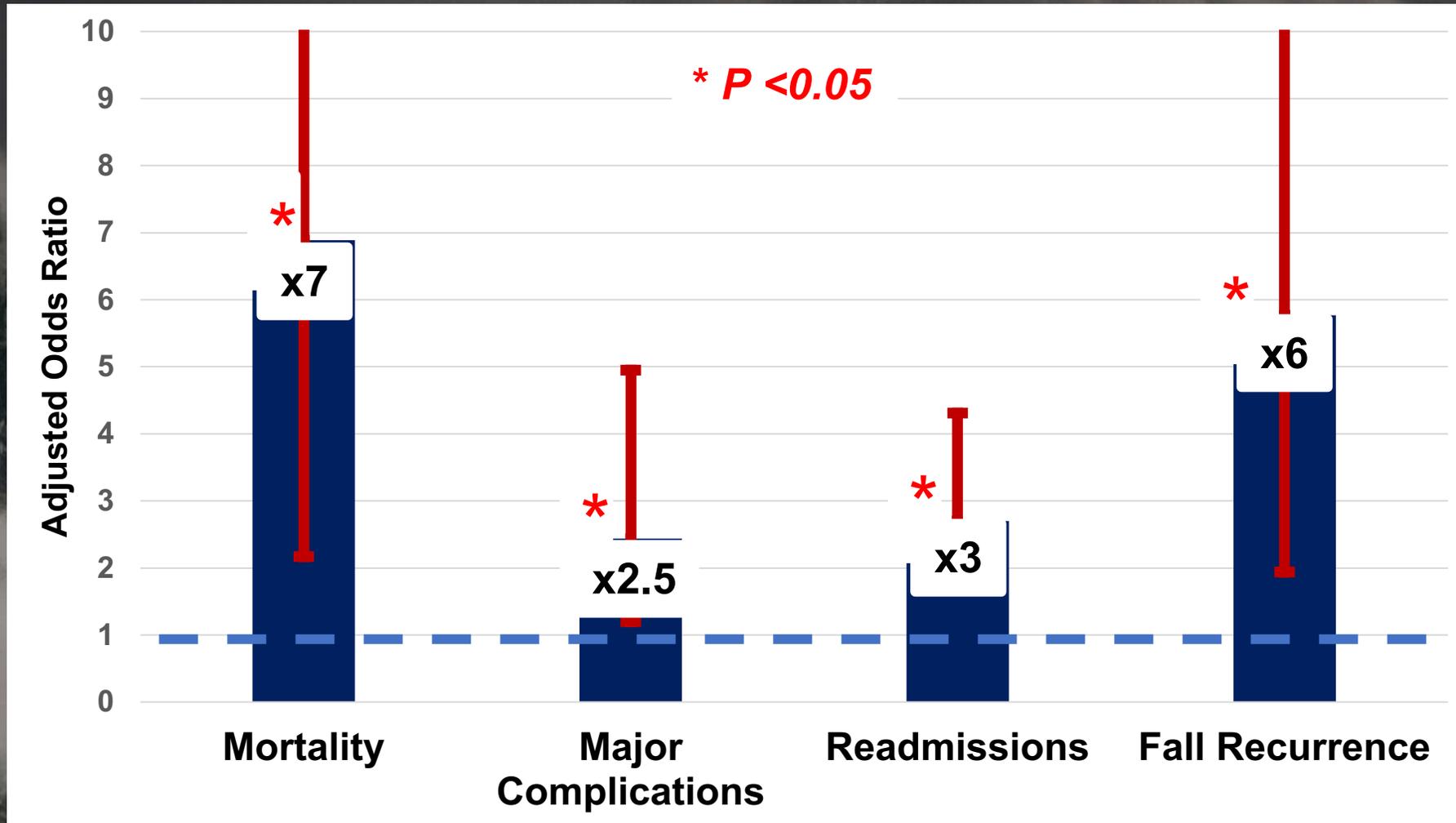
Trauma Specific Frailty Index (TSFI)
Multi-institutional Trial Study Group



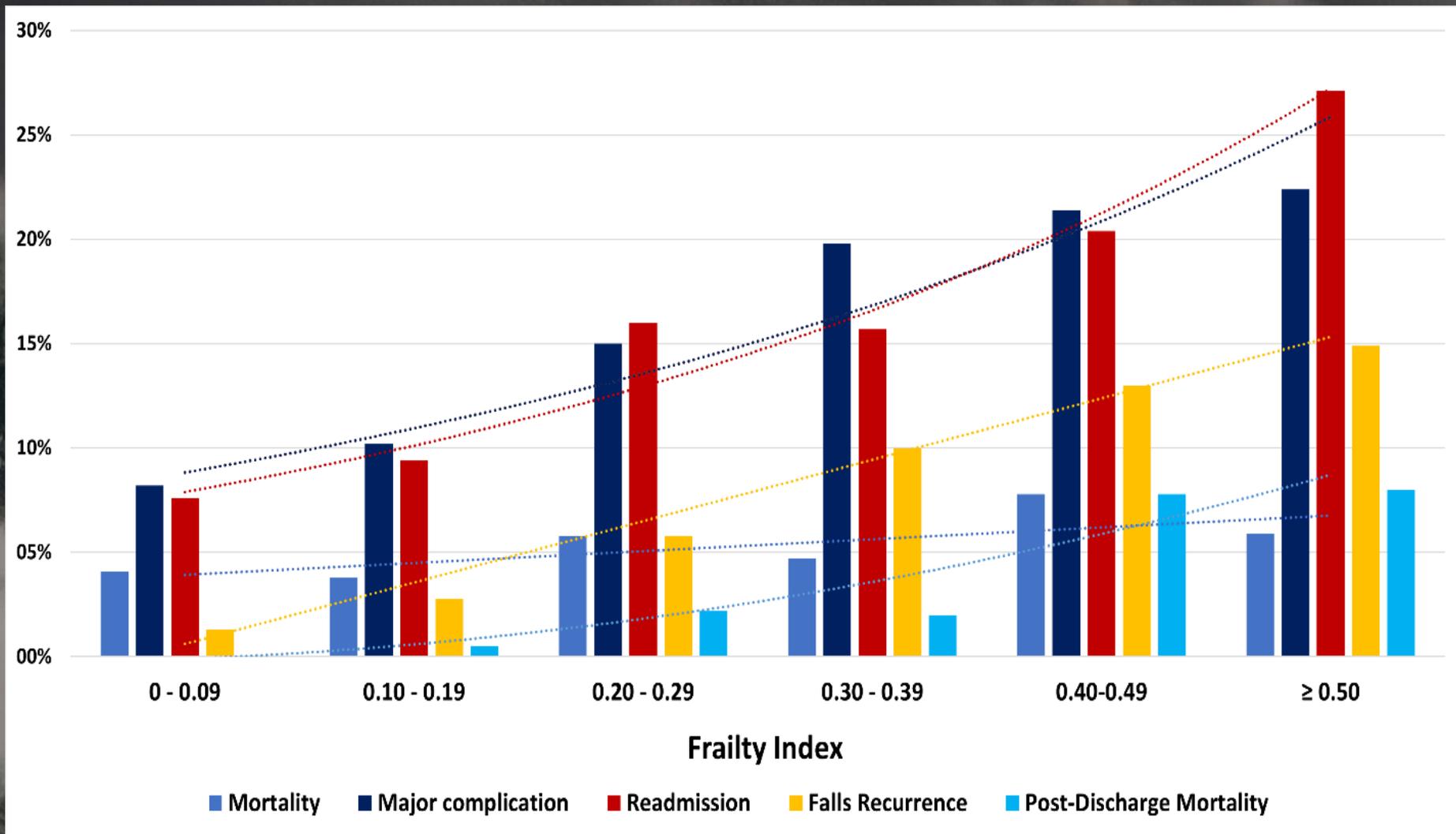
Independent Effect of Frailty on Index Admission Outcomes



Independent Effect of Frailty on 3-months Outcomes



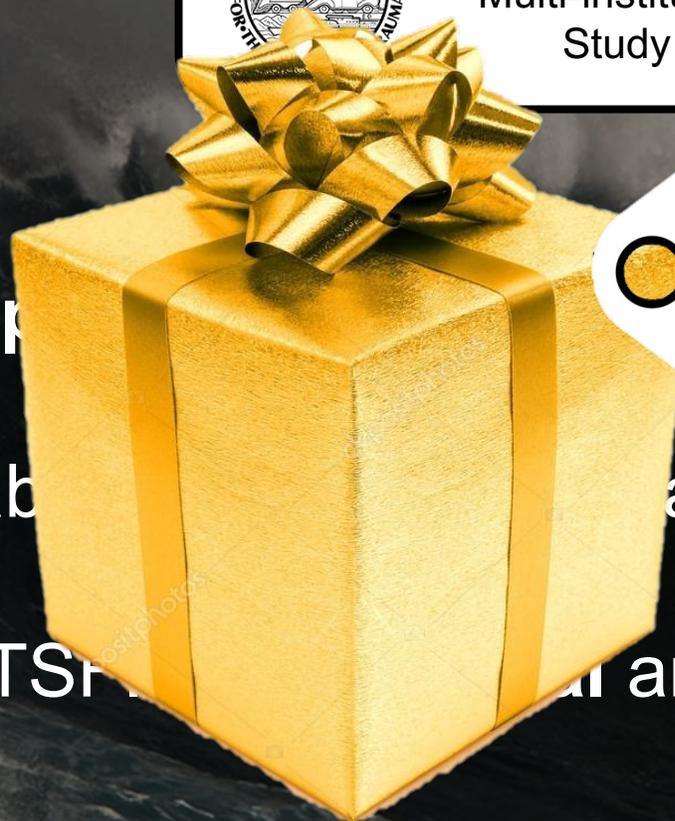
The Frailty Spectrum – Increasing TSFI



Trauma Specific Frailty Index (TSFI)



Multi-institutional Trial
Study Group



To: Georgia

From : Arizona



Report

and long-term outcomes

• Prospective

• Reliable

• The TSFI is a valid and effective risk-stratification tool

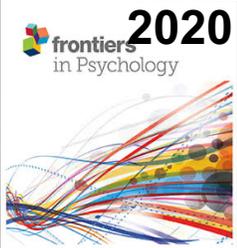




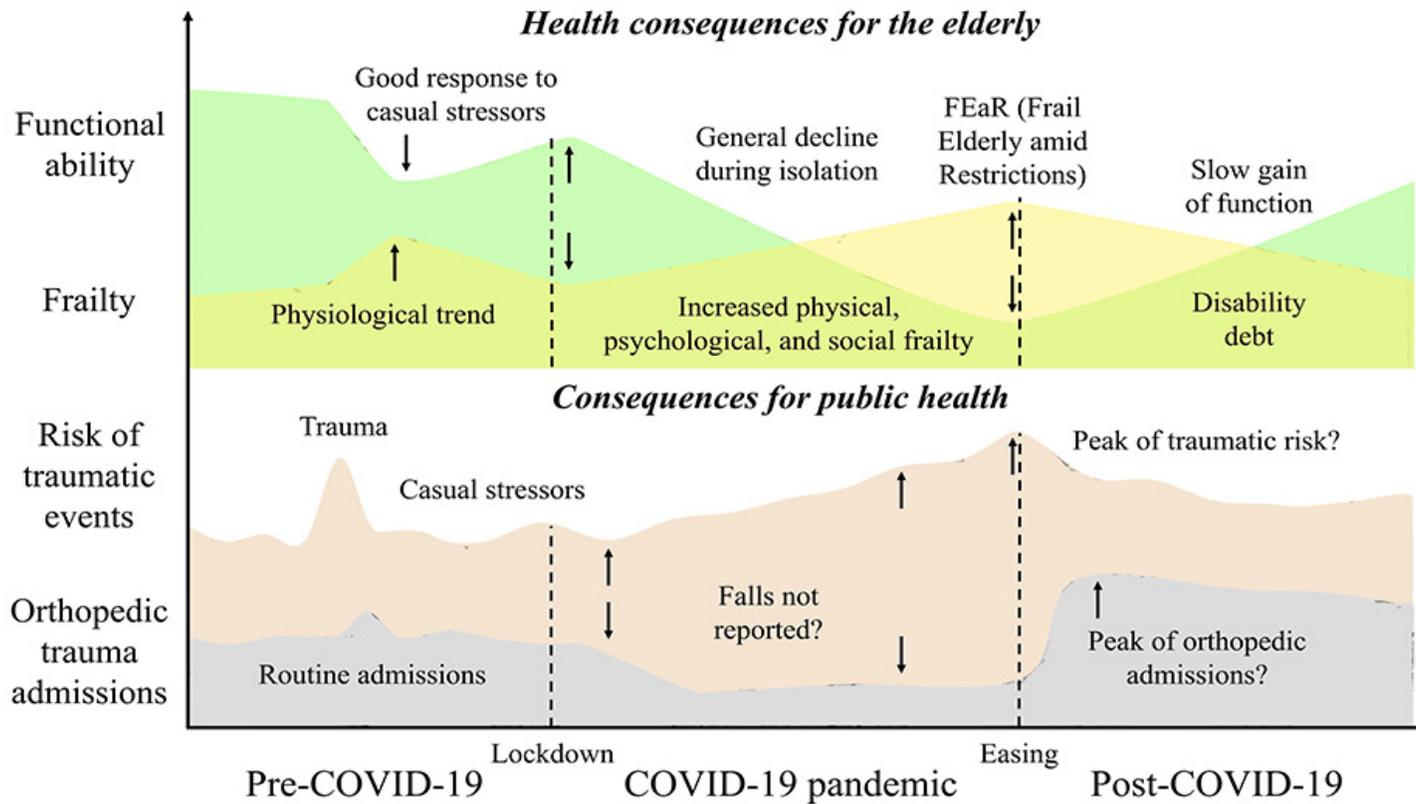
New Challenges

Consequences for the Elderly After COVID-19 Isolation: FEaR (Frail Elderly amid Restrictions)

Matteo Briguglio, Riccardo Giorgino, Bernardo Dell'Osso, Matteo Cesari, Mauro Porta, Fabrizia Lattanzio, Giuseppe Banfi and Giuseppe M. Peretti



Consequences for the Elderly after COVID-19 Isolation



↓ Functional Ability

↑ Risk of Trauma

↑ Frailty

↑ Orthopedic Admissions

Saturation of Healthcare Services

Worsened age-associated conditions

↑ Risk of Traumatic Falls

↑ Frailty (Restriction Derived)

↓ Resilience

↑ Anxiety-depressive traits



**The Silent Killer in Trauma -
Malnutrition**

The Silent Killer in Trauma: The Implications of Malnutrition on Outcomes of Older Adults

H. Hosseinpour, K. El-Qawaqzeh, L. J. Magnotti, SK. Bhogadi, A. Nelson, Q. Alizai, T. Anand, C. Colosimo, M. Ditillo, B. Joseph

- Secondary analysis of AAS-MIT (2019-2022), 17 TCs
- 1,321 prospectively enrolled pts (≥ 65)
- To evaluate impact of malnutrition outcomes
- Outcomes: Index admission & 3-month post-discharge
- Simplified Geriatric Nutritional Risk Index (albumin (g/dL) + BMI (kg/m²) / 10)



2023



23% of patients suffered from **malnutrition**:

Mild Malnutrition
(12.6%)

Moderate Malnutrition
(6.5%)

Severe Malnutrition
(2.5%)

Severe Malnutrition vs No Malnutrition



Sepsis
(aOR 8.7)



Pneumonia
(aOR 4.4)



**In-hospital
Mortality**
(aOR 4.1)



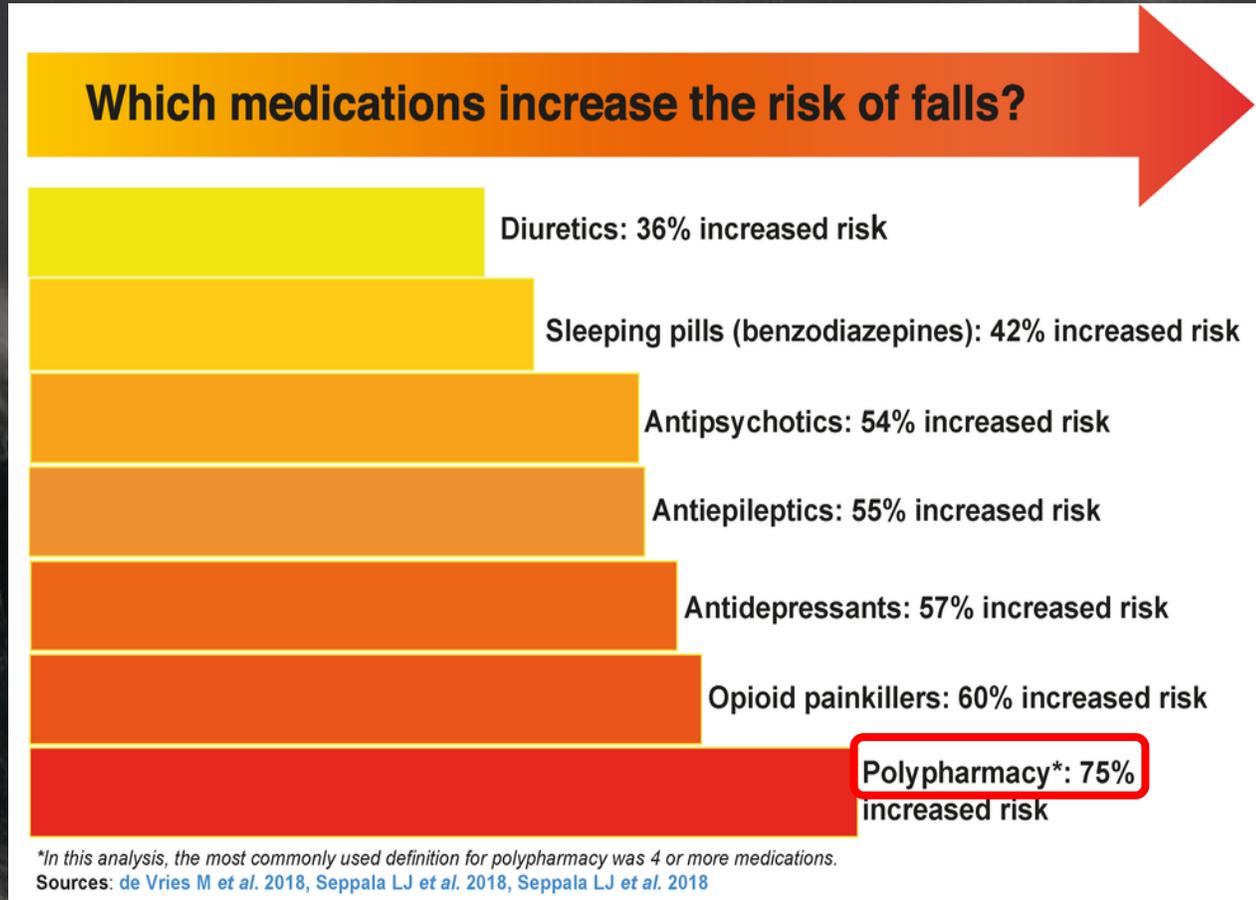
**3-month
Mortality**
(aOR 16.9)

Patient-related Factors

Medications - Polypharmacy



Medications, Fall Risk & Poor Outcomes



Geriatrics on **≥ 5 medications** are at increased risk for **complications, lower functional outcomes, and longer hospital and ICU LOS**

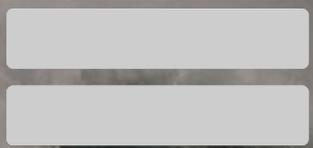
Anticoagulants



Falling Elderly



Eliquis



Felliquis?!



Anticoagulants

**Preinjury
Anticoagulation**



**ICH
(x2)**

**Mortality
(x2)**

The novel oral anticoagulants (NOACs) have worse

**NOACs
vs Warfarin**



**ICH Progression
(x2)**

**NSI
(x2)**

**ICU LOS
(x3)**

**Mortality
(x2)**

**In Patients with
Blunt SOI**



**Failure
of NOM
(x2)**

**Hospital
& ICU LOS
(x1.2)**

**Cardiac
Complications
(x3)**

**AKI
(x2)**

**Mortality
(x2)**

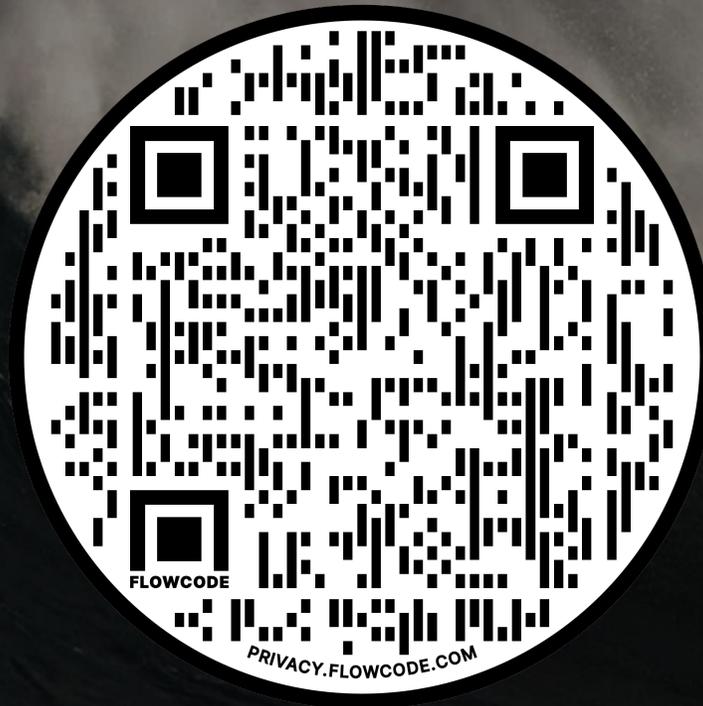
Reversal or Supportive Care?





Early Anticoagulant Reversal After Trauma

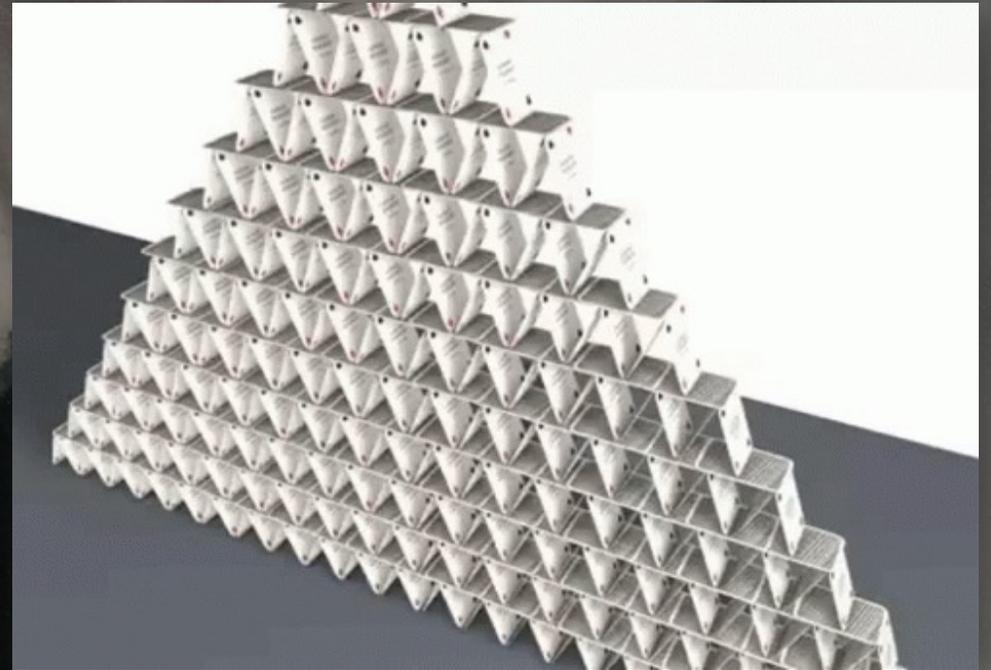
WTA - 2021





Optimal Timing to Restart AC Following Trauma?

Maybe patient-related factors can't be changed



But **system-related factors** can!

Elderly Pts Do Worse After Trauma

Patient-Related Factors



- Aging
- Frailty
- Comorbidities
- Polypharmacy
- Anti-coagulants

Hospital/System Related Factors



- Triage, Trauma Activation
- Multidisciplinary Care
- Hospital/ Surgeon Volume
- Geriatric Trauma Centers

Hospital/system-related Factors

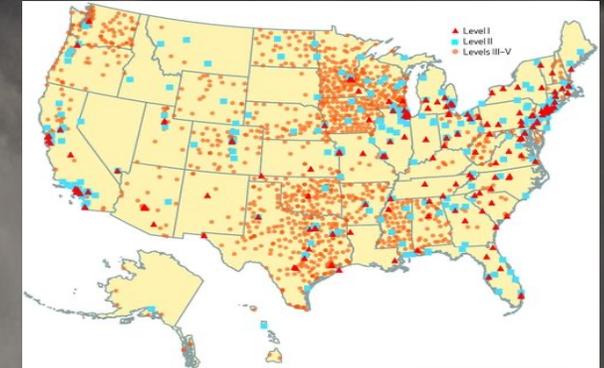


- Triage, Trauma Activation
- Multidisciplinary Care
- Hospital/ Surgeon Volume
- Geriatric Trauma Centers

Hospital/system-related Factors



WHO IS TO BLAME?



A position paper: The convergence of aging and injury and the need for a Geriatric Trauma Coalition (GeriTraC)

Zara Cooper, Cathy A Maxwell, Samir M Fakhry, Bellal Joseph, Nancy Lundebjerg, Peter Burke, Robert Baracco





Trauma Team Activations

Trauma Team Activations



Same response



Age alone is not a good indicator for trauma activation

Outdated triage criteria

Geriatric trauma patients have a blunted physiologic response to injury

High rates of both over- and under-triage

Optimal triage criteria not yet defined

Specialized triage scores & activations are required

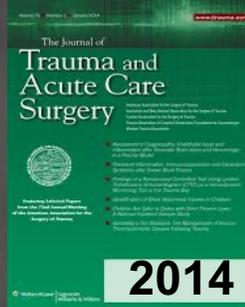
Triage – Shock Index



Shock index predicts mortality in **geriatric** trauma patients

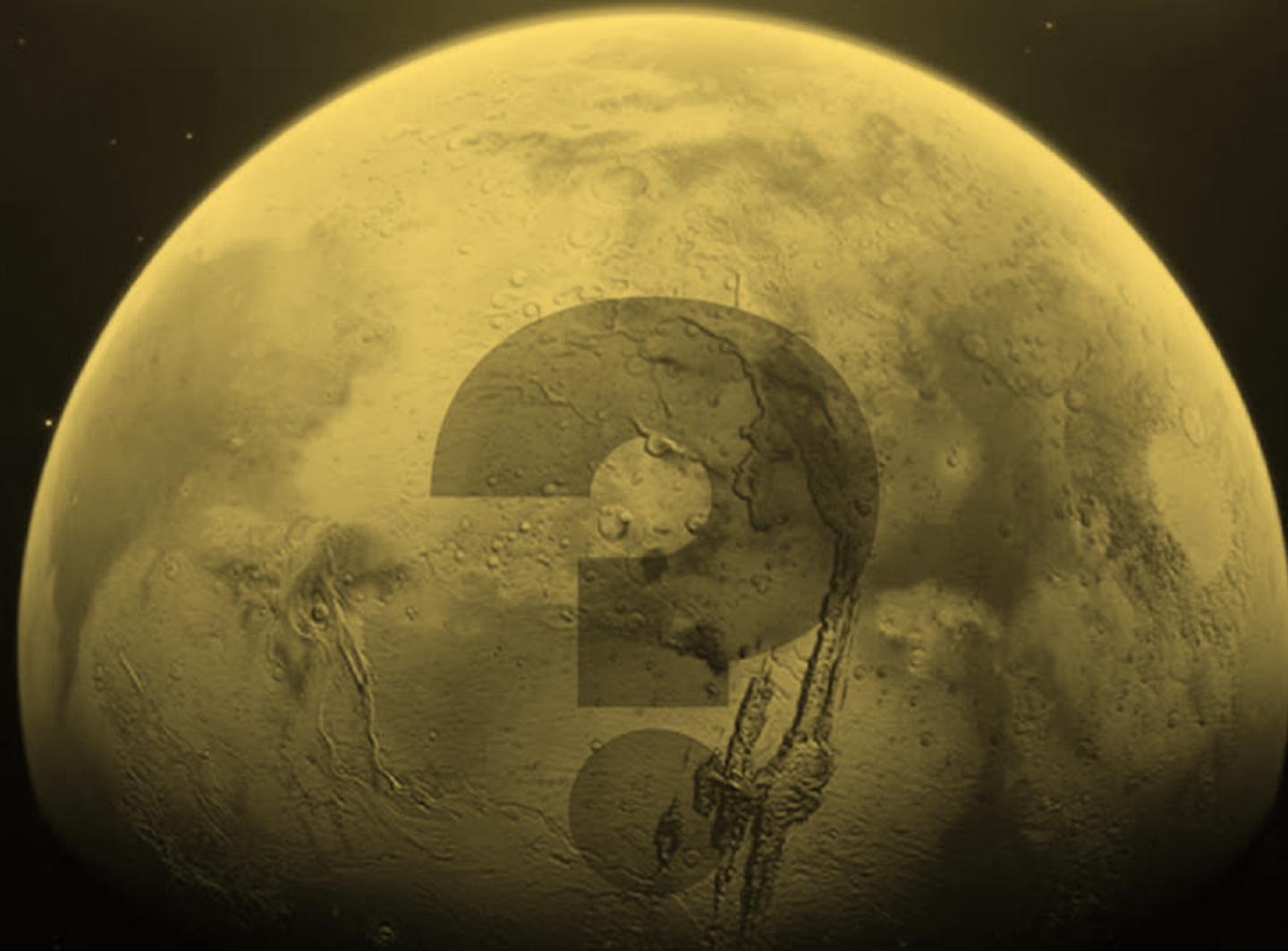
An analysis of the National Trauma Data Bank

Pandit, Viraj MD; Rhee, Peter MD; Hashmi, Ammar MD; Kulvatunyou, Narong MD; Tang, Andrew MD; Khalil, Mazhar MD;
O’Keeffe, Terence MbChB; Green, Donald MD; Friese, Randall S. MD; Joseph, Bellal MD



- **4-yr** (2007–2010) analysis of NTDB, **≥ 65 yr** included
- A total of 485,595 geriatric patients
- Aim: Assess the utility of **shock index** in predicting outcomes

SI is superior to **SBP** & **HR** for predicting mortality in geriatric trauma patients yet **underutilized**



The Optimal Triage Criteria?

Suggested Triage Criteria

- GLF patients on **antithrombotic agents**
- Systolic blood pressure **<110 mm Hg**
- Heart rate **> 90 bmp**
- **Shock Index >1**
- GLF **not** on anticoagulants with **GCS < 14** + signs of TBI



THE
COMMITTEE
ON **TRAUMA**

QUALITY PROGRAMS
of the AMERICAN COLLEGE
OF SURGEONS

Introducing



- **G** – Geriatric Ground-Level Falls
- **O** – Objectification (Scoring Models)
- **L** – Less Dependent on Vitals
- **D** – Drugs (Pre-injury Anticoagulants)

Trauma Gold!



Working up Trauma Patients?

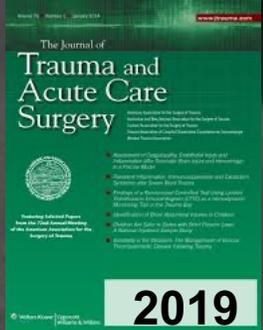
A large, white iceberg floats in the dark blue ocean. The iceberg has a flat top and a jagged, broken edge. A small, dark figure is visible on the top surface of the iceberg. The water around the iceberg is a lighter, turquoise color, suggesting a shallow depth or a specific type of water. In the background, other smaller icebergs are visible on the horizon under a grey, overcast sky.

A Simple Fall In The Elderly?

Not So Simple

Fall downs should not fall out: Blunt cerebrovascular injury in geriatric patients after low-energy trauma is common

Flashburg, Erika DO; Ong, Adrian W. MD; Muller, Alison MLS, MSPH; Sherwood, Alicia PA-C; Wilhelm, Sara MS; Zavilla, Jared MS; Martin, Anthony P. BSN; Castor, Laura MS; Barbera, Spencer C.; Reinhart, Reid BS; Layser, Shane MSN; McBride, William C. MD; Romeo, Michael DO; Fernandez, Forrest B. MD



- Single center (2012-2016) study
- **997** geriatric trauma patients with **falls of 5 ft or less**
- Aim: to examining the impact of BCVI screening for geriatric falls



**257 met Denver
Criteria**



**23% diagnosed
with BCVI**

Ground Level Falls

Managing Older Adults with Ground-Level Falls Admitted to a Trauma Service: The Effect of Frailty

Bellal Joseph MD, Viraj Pandit MD, Mazhar Khalil MD, Narong Kulvatunyou MD, Bardiya Zangbar MD, Randall S. Friese MD, M. Jane Mohler PhD, Mindy J. Fain MD, Peter Rhee MD



2015

- **Prospective** study at a level 1 TC
- Included **≥65 yrs** presenting after a **GLF**
- To determine if **frail** pts are at greater **risk of fractures after a GLF**
- Used the 50-variable modified frailty index
- Radiologist reviewed all X-rays & CTs, & a trauma surgeon confirmed

110 Participants

- **38% were frail** & **40% had a new fracture**

Frail vs Non-frail

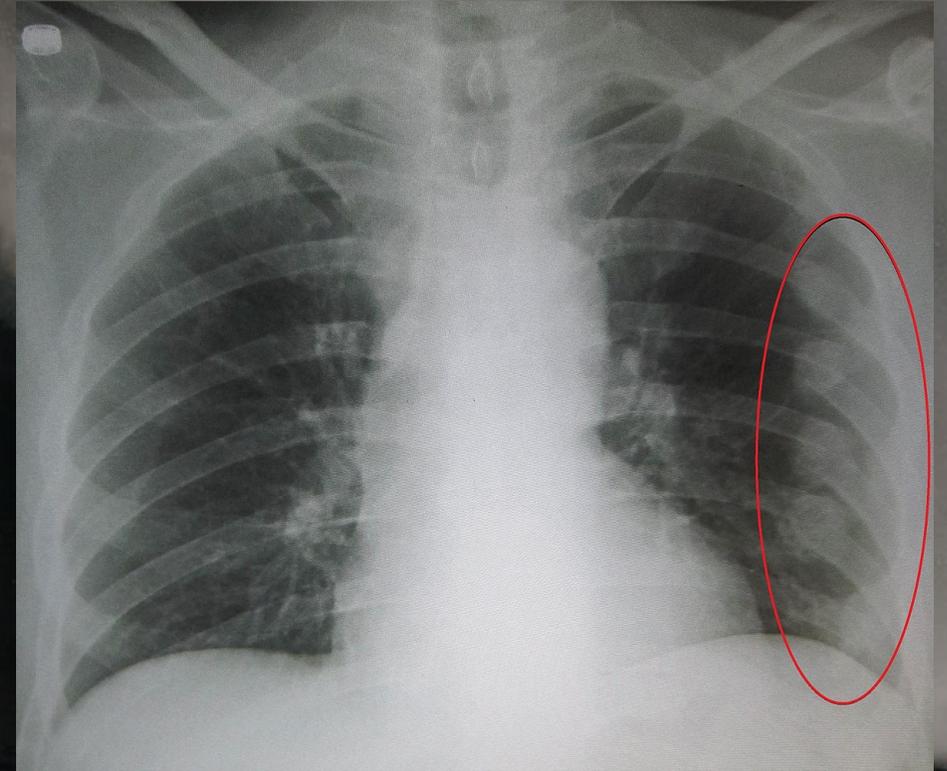


Fractures Following GLF
(aOR = x2)

Table 1. Details of Fractures and Outcomes

Variable	Frail, n = 43	Nonfrail, n = 67	P-Value
Rib, n (%)	7 (16.3)	5 (7.5)	.12
Upper extremity			
Humerus	6 (13.9)	6 (8.9)	.31
Radius	8 (18.6)	4 (6.0)	.045
Ulna	3 (7.0)	5 (7.5)	.85
Lower extremity, n (%)			
Femur	7 (16.3)	3 (4.5)	.04
Tibia	9 (21.0)	5 (7.5)	.04
Fibula	7 (16.3)	9 (13.4)	.72
Spine, n (%)			
Cervical	1 (2.3)	0 (0.0)	—
Thoracic	4 (9.3)	1 (1.5)	.04
Lumbar	4 (9.3)	1 (1.5)	.04
Pelvic, n (%)	2 (4.6)	2 (3.0)	.71
In-hospital complications, n (%)	7 (16.2)	3 (4.5)	.03

Rib Fractures



0022-5282/00/4806-1040
The Journal of Trauma: Injury, Infection, and Critical Care
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Rib Fractures in the Elderly

Eileen M. Bulger, MD, Matthew A. Arneson, MD, Charles N. Mock, MD, PhD, and Gregory J. Jurkovich, MD

Background: We sought to ascertain the extent to which advanced age influences the morbidity and mortality after rib fractures (fxs), to define the relationship between number of rib fractures and morbidity and mortality, and to evaluate the influence of analgesic technique on outcome.

Methods: A retrospective cohort study involving all 277 patients ≥ 65 years old with rib fxs admitted to a Level I trauma center over 10 years was undertaken. The control group consisted of 187 randomly selected patients, 18 to 64 years old, with rib fxs admitted over the same time period. Outcomes included pulmonary complications, number of ventilator days, length of intensive care unit and hospital stay (LOS), disposition, and mortality. The specific analgesic technique used was also examined.

Results: The two groups had similar mean number of rib fxs (3.6 elderly vs. 4.0 young), mean chest Abbreviated Injury Scores (3.0 vs. 3.0), and mean Injury Severity Score (20.7 vs. 21.4). However, mean number of ventilator days (4.3 vs. 3.1), intensive care unit days (6.1 vs. 4.0), and LOS (15.4 vs. 10.7 days) were longer for the elderly patients. Pneumonia occurred in 31% of elderly versus 17% of young ($p < 0.01$) and mortality

was 22% for the elderly versus 10% for the young ($p < 0.01$). Mortality and pneumonia rates increased as the number of rib fxs increased with and odds ratio for death of 1.19 and for pneumonia of 1.16 per each additional rib fracture ($p < 0.001$). The use of epidural analgesia in the elderly (LOS >2 days) was associated with a 10% mortality versus 16% without the use of an epidural ($p = 0.28$). In the younger group (LOS >2 days), mortality with and without the use of an epidural was 0% and 5%, respectively.

Conclusion: Elderly patients who sustain blunt chest trauma with rib fxs have twice the mortality and thoracic morbidity of younger patients with similar injuries. For each additional rib fracture in the elderly, mortality increases by 19% and the risk of pneumonia by 27%. As the number of rib fractures increases, there is a significant increase in morbidity and mortality in both groups, but with different patterns for each group. Further prospective study is needed to determine the utility of epidural analgesia in this population.

Key Words: Rib fractures, Geriatric trauma, Epidural analgesia, Pneumonia.

Morbidity from Rib Fractures Increases after Age 45

John B Holcomb, MD, FACS, Neil R McMullin, BS, Rosemary A Kozar, MD, PhD, FACS, Marjorie H Lygas, MS, FNP, Frederick A Moore, MD, FACS



BACKGROUND: Recent studies have demonstrated increased morbidity in elderly patients with rib fractures after blunt trauma. As a first step in creating a multidisciplinary rib fracture clinical pathway, we sought to determine the relationship between increasing age, number of rib fractures, and adverse outcomes in blunt chest trauma patients, without major abdominal or brain injury.

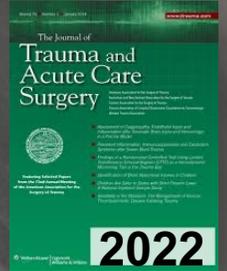
STUDY DESIGN: We performed a retrospective cohort study involving all blunt patients greater than 15 years old with rib fractures, excluding those with Abbreviated Injury Scores (AIS) greater than 2 for abdomen and head, admitted to an urban Level I trauma center during 20 months. Outcomes parameters included the number of rib fractures, Injury Severity Score (ISS), intrathoracic injuries, pulmonary complications, number of ventilator days, length of stay in the intensive care unit (ICU), hospital stay, and type of analgesia.

RESULTS: Of the 6,096 patients admitted, 171 (2.8%) met the inclusion criteria. Based on an analysis of increasing age, number of rib fractures, and adverse outcomes variables, patients were separated into four groups: group 1, 15 to 44 years old with 1 to 4 rib fractures; group 2, 15 to 44 years old with more than 4 rib fractures; group 3, 45 years or older with 1 to 4 rib fractures; and group 4, 45 years or more with more than 4 rib fractures. The four groups had similar numbers of pulmonary contusions (30%) and incidence of hemopneumothorax (51%). Ventilator days (5.8 ± 1.8), ICU days (7.5 ± 1.8), and total hospital stay (14.0 ± 2.2) were increased in group 4 patients compared with the other groups ($p < 0.05$). Epidural analgesia did not affect outcomes. Overall mortality was 2.9% and was not different between groups.

CONCLUSIONS: Patients over the age of 45 with more than four rib fractures are more severely injured and at increased risk of adverse outcomes. Efforts to decrease rib fracture morbidity should focus not only on elderly patients but those as young as 45 years. Based on these data we have initiated a multidisciplinary clinical pathway focusing on patients 45 years and older who have more than four rib fractures. (J Am Coll Surg 2003;196:549-555. © 2003 by the American College of Surgeons)

Prospective validation of the Rib Injury Guidelines for traumatic rib fractures

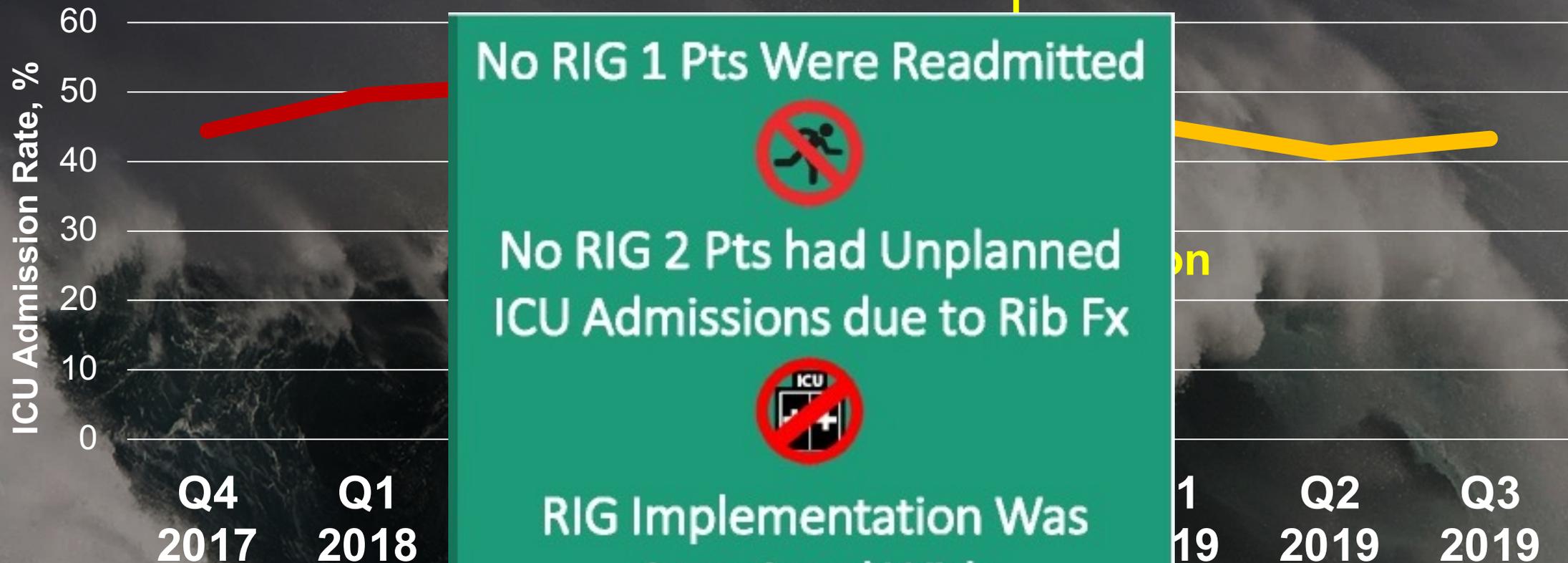
Nelson, Adam MD; Reina, Raul MD; Northcutt, Ashley MD; Obaid, Omar MD; Castanon, Lourdes MD; Ditillo, Michael DO; Gries, Lynn MD; Bible, Letitia MD; Anand, Tanya MD; Joseph, Bellal MD



RIG Score Calculator	
Variable	Points
Age ≥60 years	4
Incentive Spirometry <750 mL	4
Severe pulmonary contusions on CT scan	2
Rib fractures ≥5	2
COPD, Asthma, or smoker	2
Hemothorax, Pneumothorax, or chest tube placed	2
Pain score ≥6/10	1
Weak or absent cough	1

RIG Category	RIG Score	Disposition
RIG 1	≤2	Discharge if possible
RIG 2	3-9	Floor
RIG 3	≥10 or severe extra-thoracic injuries	ICU

ICU Admission Rates For Rib Fracture Patients Over Time



45% ICU admission

No RIG 1 Pts Were Readmitted



No RIG 2 Pts had Unplanned ICU Admissions due to Rib Fx



RIG Implementation Was Associated With




&



ICU & Hosp LOS Mortality

Mortality
(7.7 vs. 5.8, p=0.252)

Hospital Volume



Is it the Hospitals?



Low Geriatric Proportion Low Geriatric Volume Positive and Negative Volume-Outcome Relationships in the Geriatric Trauma Population

Kazuhide Matsushima, MD; Eric W. Schaefer, MS; Eugene J. Worsham, BA; et al



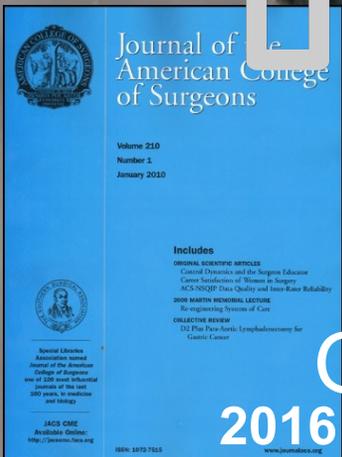
Failure-to- Major In-Hospital In-hospital 30-Day

Does Hospital Experience Rather than Volume

Improve Outcomes in Geriatric Trauma Patients?

Olubode A Olufajo, MD, MPH, David Metcalfe, LLB, MSc, Arturo Rios-Diaz, MD, Elizabeth Lilley, MD, MPH, Joaquim M Havens, MD, FACS, Edward Kelly, MD, FACS, Joel S Weissman, PhD, Adil H Haider, MD, MPH,

Proportion Volume



What Does The Future Hold?





The Silver Service

There is a dire need for geriatric-specific

- **Resources/Trauma Bays/ICUs**
- **Resuscitation Guidelines**
- **Multidisciplinary Care**
- **Clinical Care Pathways**



Multidisciplinary Care



Intervene at every point!

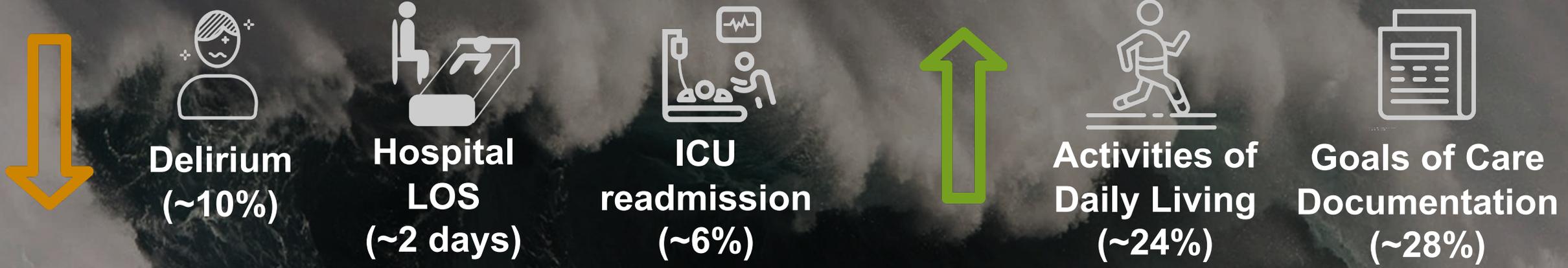
A systematic review and meta-analysis evaluating **geriatric consultation** on older trauma patients

Eagles, Debra MD, MSc; Godwin, Bradley MD, HBSc; Cheng, Wei PhD; Moors, Joy RN, BScN; Figueira, Sonshire MD; Khoury, Lara MD; Fournier, Karine MSI; Lampron, Jacinthe MD, MPH



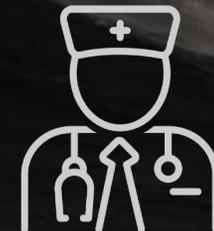
- A systematic review of **8 studies**
- To determine the impact of a **geriatric consultation** on outcomes
- All conducted in verified **trauma centers**
- Pre- & Post-intervention studies

Comprehensive Geriatric Assessment:



 Only one geriatrician for every 2,546 older Americans

More Geriatric Specialists are needed



Identify Frailty Early



Frailty screening and a frailty pathway decrease length of



Frailty Care Pathway

Hospitalist Consult

Specialized Order-set

Social Worker Involvement
for Social Needs/Goals

Nutritional/Speech/PT/OT &
Language Therapist Consult

Early Family Engagement

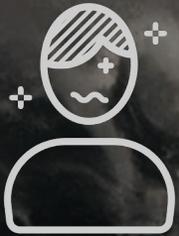
Post-discharge Follow-up

Elizabeth A. Bryant, MPH, Samir Tulebaev, MD, Manuel Castillo-Angeles, MD, MPH, Esther Moberg, MPH, Steven S. Senglaub, MS, Lynne O'Mara, PAC, Meghan McDonald, RN, MSN, Ali Salim, MD, FACS, Zara Cooper, MD, MSc, FACS

2020



Frailty Care Pathway



**Delirium
(60%)**



**Hospital
Length of
Stay
(25%)**



**30-Day
Readmission
(75%)**



**Loss of
Independence
(40%)**

Association Between Implementation of a Geriatric Trauma Clinical Pathway and Changes in Rates of Delirium in Older Adults With Traumatic Injury

Kazuhide Caroline Park, MD, PhD; Ankur Bharija, MD; Matthew Mesias, MD; et al



- 2-year (2018-2020) analysis of a single **level I trauma center**
- **712** non-operatively managed geriatric trauma patients (≥ 65 years)
- To assess the **geriatric trauma clinical pathway** on rates of **delirium**

Multi-Disciplinary Geriatric Care Team & 4M Key Elements



Medications



Mentation



Mobility

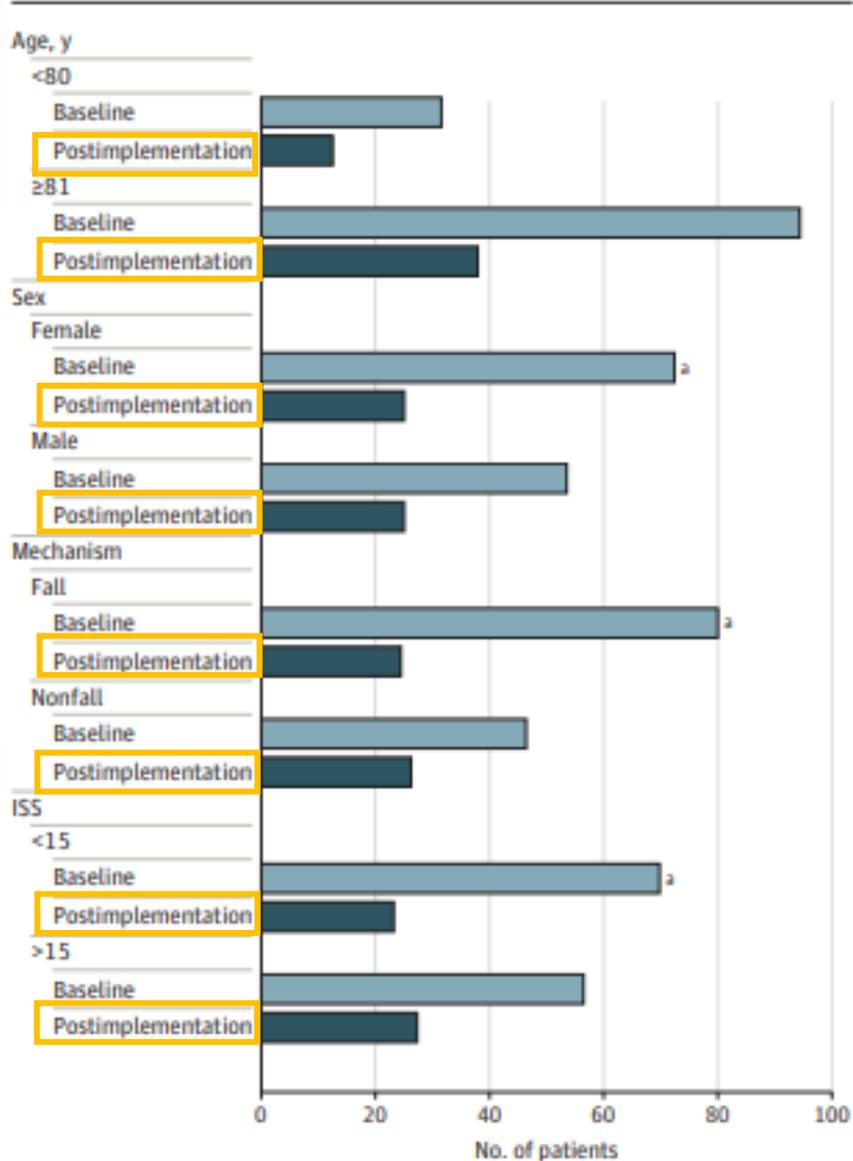


What Matters

Geriatric Trauma Clinical Pathway



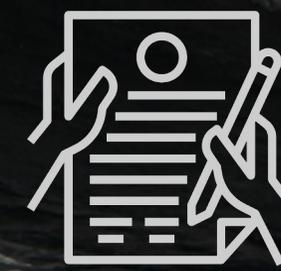
Figure. Percent Reduction in Delirium for Postimplementation and Baseline Cohorts



60% Reduction in Delirium



Improved goals of care documentation by 37%



A Comprehensive Multidisciplinary Approach— The Ideal Future State of Geriatric Trauma Care

Katherine L. Florecki, MD; Bellal Joseph, MD; Elliott R. Haut, MD, PhD



The 4M key elements play an important role, however:

- The precise subset of patients who would benefit the most?
- The possible differential effect in **frail vs non-frail** patients?
- How do the findings impact **underrepresented minorities**?

Advancing An Age-friendly Initiative: Integrating 4ms Into Geriatric Trauma Care

M. E. Lundy, T. Anand, H. Hosseinpour, H. Eversman, SK. Bhogadi, Q. Alizai, M. Ditillo, B. Otaibi, L. J. Magnotti, B. Joseph



2023



- Aim: Effect of implementation of 4M's on outcomes of geriatric trauma
- Pre-post cohort study at Level 1 TC (2019-2022)
- Frail pts ≥ 65 yrs, all pts ≥ 80 yrs were included (Pre 159; Post 53)

Implementation of 4M



ERAS Protocols



G ERAS[®]

Preop:



- Patient education (1C)
- Carb loading (2B) / Clear liquids until 2hrs prior (1A)



- Mechanical & oral bowel prep (2B)
- Optimize comorbidity (2B)

Intraop:



- Preset orders (2C)
- SSI bundle: abx / prep (1B)
- Pre-emptive, multimodal pain control (1B)



- Restrictive / goal directed fluid use (1B)
- Laparoscopic approach (1A)



Postop:

- Early feeding, heplock (1B)
- Multimodal pain regimen (1B)
- Early foley removal / ambulation (1B)
- No drains (1B)



Evidence-based review of trauma center care and routine palliative care processes for geriatric trauma patients; A collaboration from AAST, and EAST

Aziz, Hiba Abdel MD; Lunde, John DNP; Barraco, Robert MD, MPH; Como, John J. MD, MPH; Cooper, Zara MD, MSc; Hayward, Thomas III MD; Hwang, Franchesca MD, MSc; Lottenberg, Lawrence MD; Mentzer, Caleb DO; Mosenthal, Anne MD; Mukherjee, Kaushik MD, MSci; Nash, Joshua DO; Robinson, Bryce MD, MS; Staudenmayer, Kristan MD, MS; Wright, Rebecca PhD; Yon, James MD; Crandall, Marie MD, MPH



- A **systematic review** to create recommendations
- A query of MEDLINE, PubMed, Cochrane Library, & EMBASE
- To determine **effectiveness of palliative care processes** on outcomes
- **9 articles** relevant to palliative care processes for **geriatric trauma pts**



Recommendation



- Despite evidence of **decreased LOS & costs**, there is **insufficient evidence** on **mortality, discharge disposition, & functional outcomes**
- We are unable to make a recommendation on the use of routine palliative care processes for geriatric trauma patients

THE 12 COMPONENTS OF THE RED

- Evaluate need for and obtain language assistance
- Make follow-up appointments
- Plan for follow-up of results from pending tests and labs
- Organize postdischarge outpatient services and medical equipment
- Identify the correct medicines and a plan for a patient to obtain them
- Reconcile the discharge plan with national guidelines
- Teach a written discharge plan the patient can understand
- Educate the patient about his or her diagnosis and medicines
- Review with the patient what to do if a problem arises
- Assess the degree of the patient's understanding of the discharge plan
- Expedite the transmission of the discharge summary to clinicians accepting care of the patient
- Provide telephone reinforcement of the discharge plan



How We Do It

Frailty Screening Within 24-Hours

Prompt Diagnostic Work-Up

Strict Criteria for Geriatric Consultation (4M)
- Frail & ≥ 65 yrs or ≥ 80 yrs

Pain Pathways

G-ERAS Pathways

Discharge Planning & Post-discharge Follow-up

Geriatric Trauma Management Guidelines

ACS TQIP - 2013

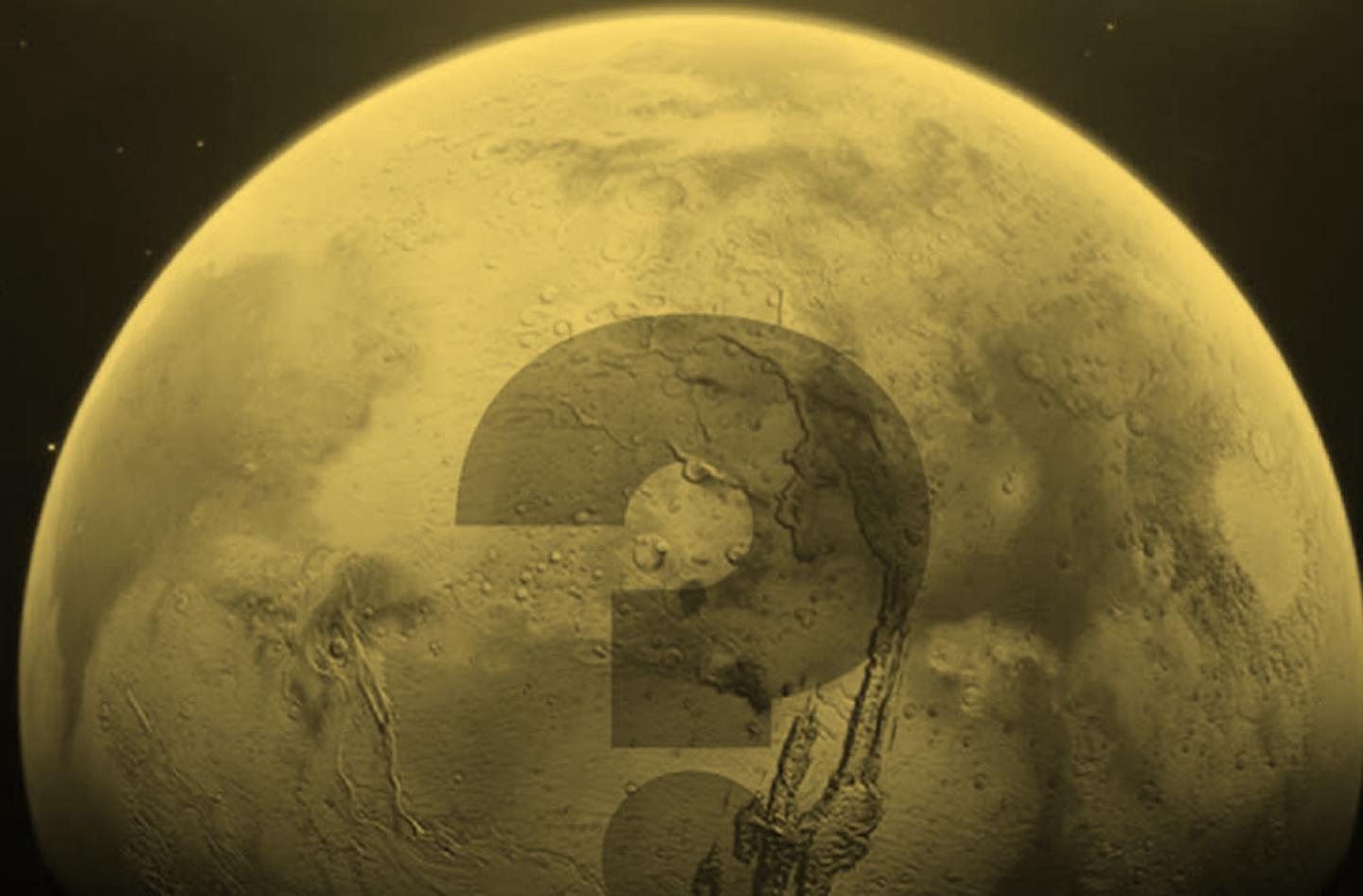


ACS COT – Updated Guidelines

COMING SOON

ACS TQIP
GERIATRIC TRAUMA
MANAGEMENT
GUIDELINES

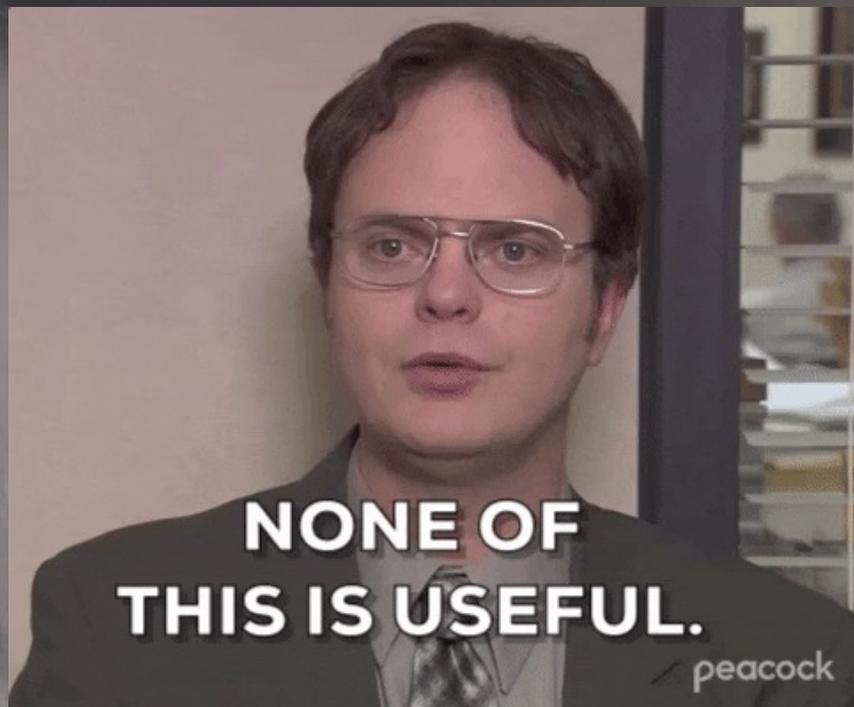




Futility of Resuscitation?

What if?

Sometimes GTPs are beyond our capabilities...



Is there a point where further efforts become INAPPROPRIATE?

Geriatric Futility of Resuscitation?



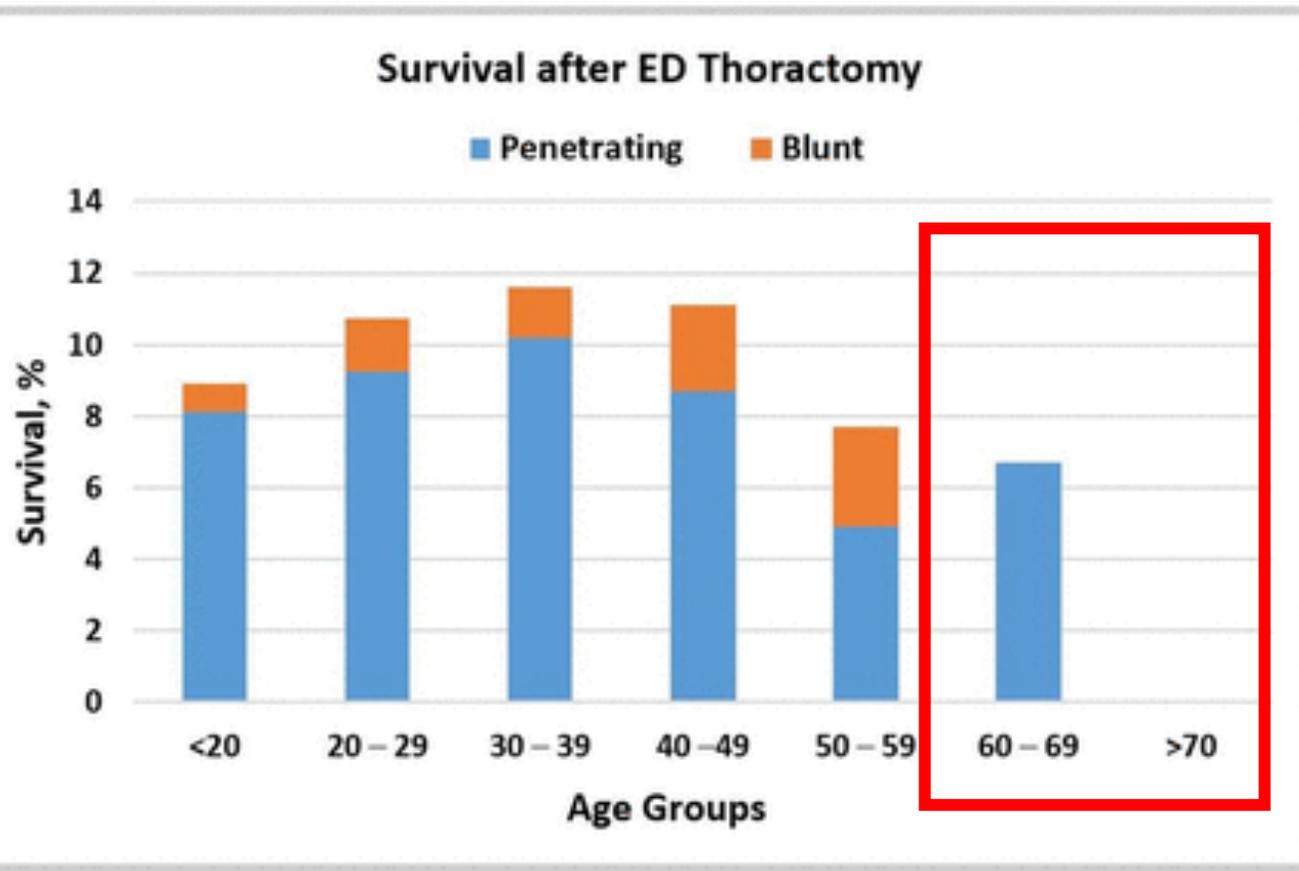
What about futility of resuscitative

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Tanya Anand; Hamidreza Ho



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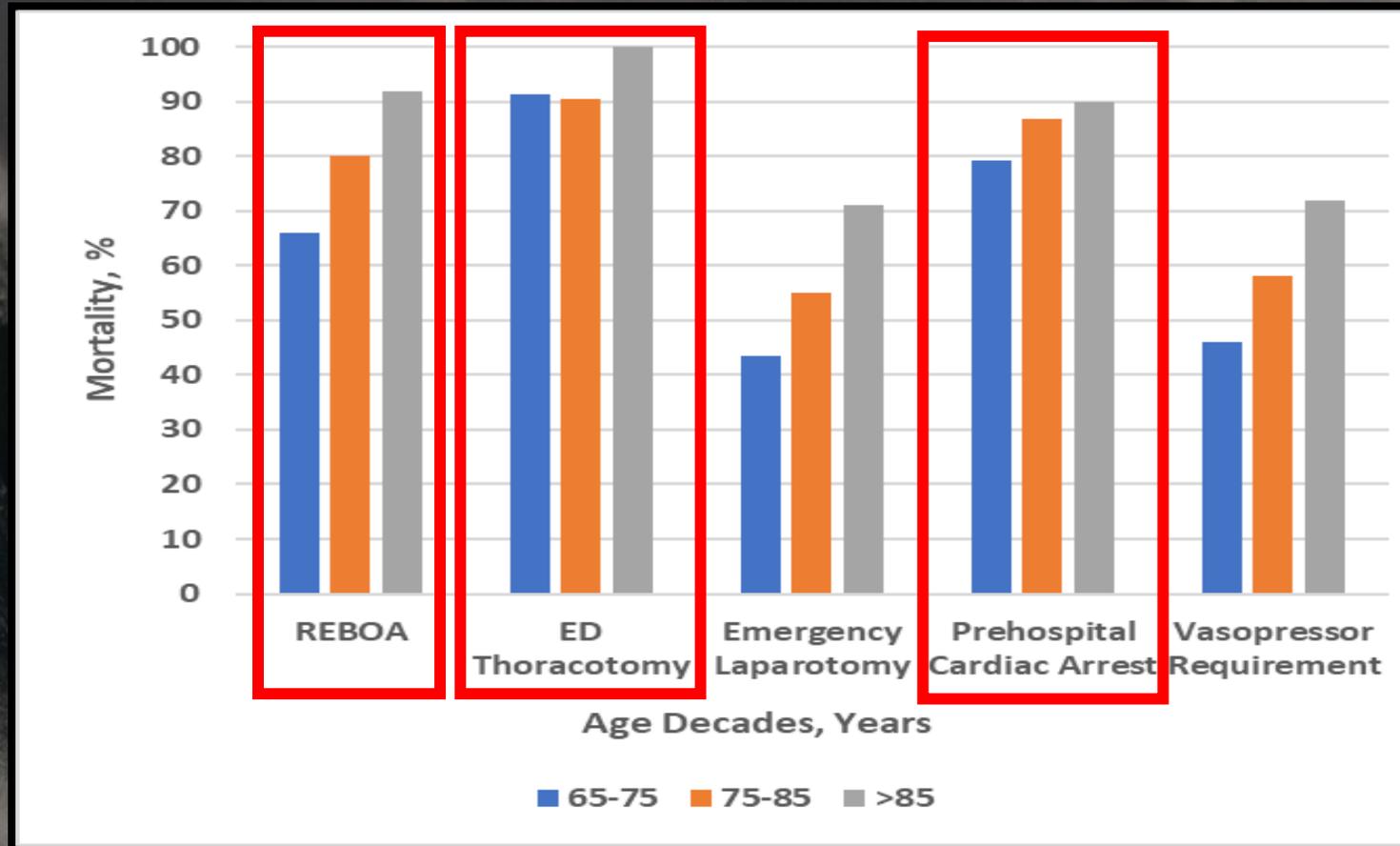
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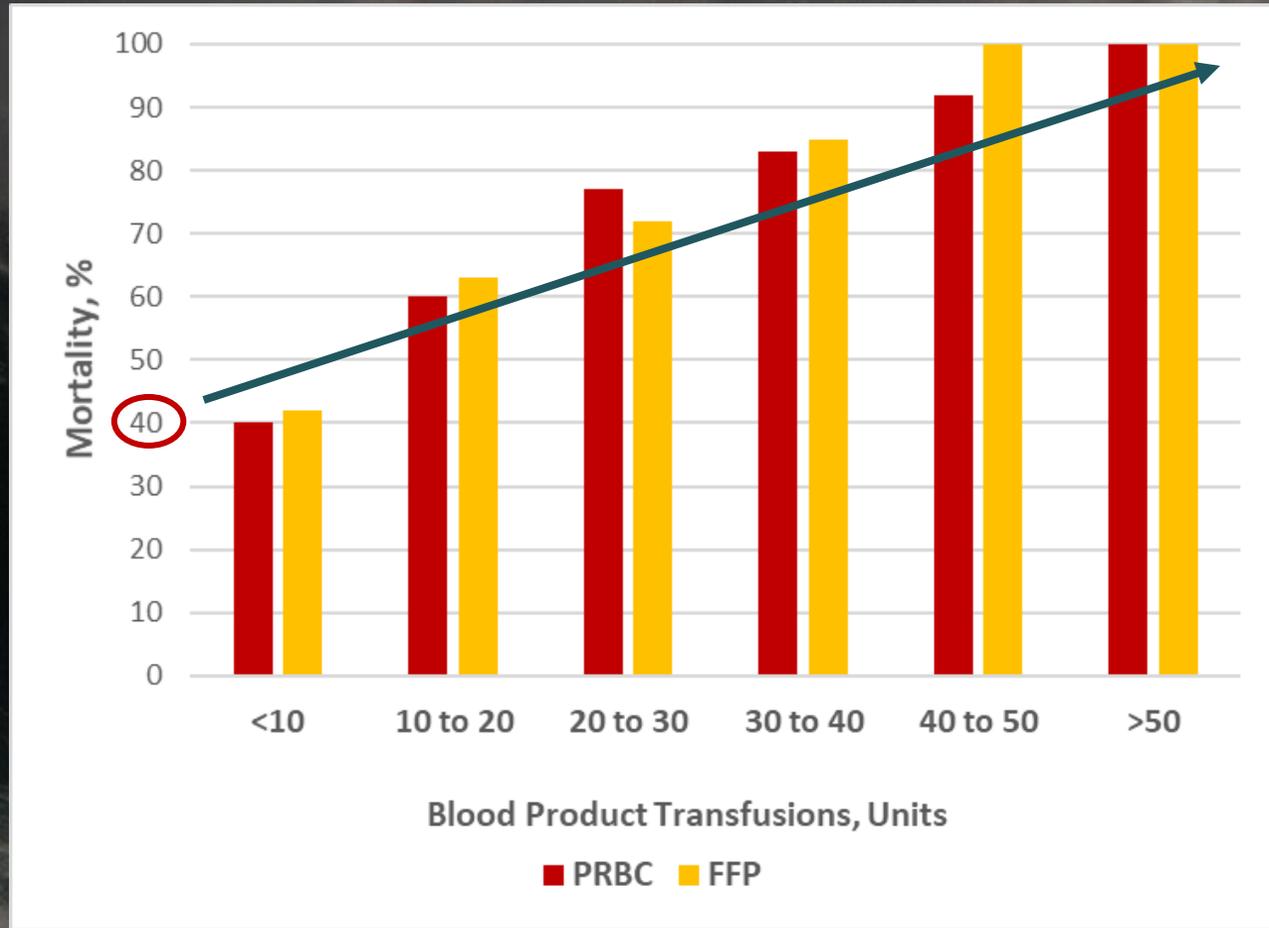


- 2018 ACS TQIP Database
- All severely injured (ISS >15) geriatric trauma patients
- Futility of resuscitation defined as mortality rate >90%

Geriatric Futility of Resuscitation?



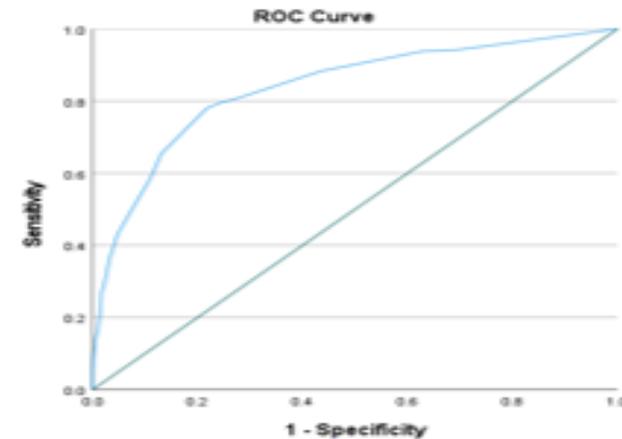
Geriatric Futility of Resuscitation?



Futility of Resuscitation Measure

Futility of Resuscitation Measure	Points
Age 60-70 yrs	0
70-80 yrs	2
>80 yrs	3
Frailty	1
Prehospital Cardiac Arrest	7
≥1 Episode of SBP <50 mm Hg	6
Early Vasopressors (<6 hrs)	2
ED Thoracotomy	9
REBOA	1
PRBC Within 4 hrs ≤5 Units	0
6-10 Units	3
11-15 Units	6
16-20 Units	7
>20 Units	9
Severe TBI and GCS ≤8	7
TBI Midline Shift	1
Craniectomy	1

FoRM Score	Mortality
0-4	10%
5-8	40%
9-12	55%
13-16	79%
17-20	81%
21-24	94%
>24	100%



AUROC=0.836; $p<0.001$
[95% CI 0.809-0.864]

GFTR Score

TSFI

FoRM Score

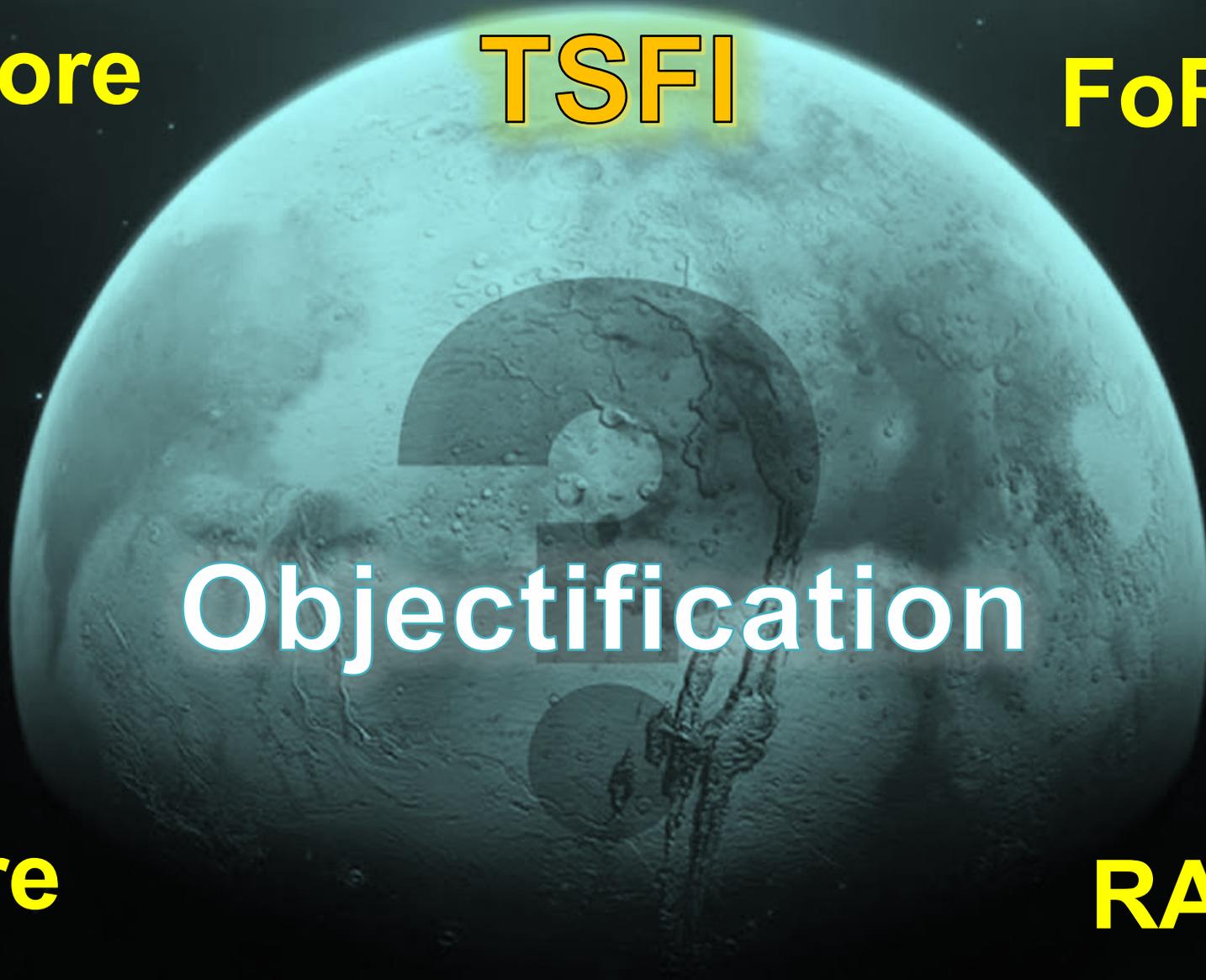
RIG

BIG

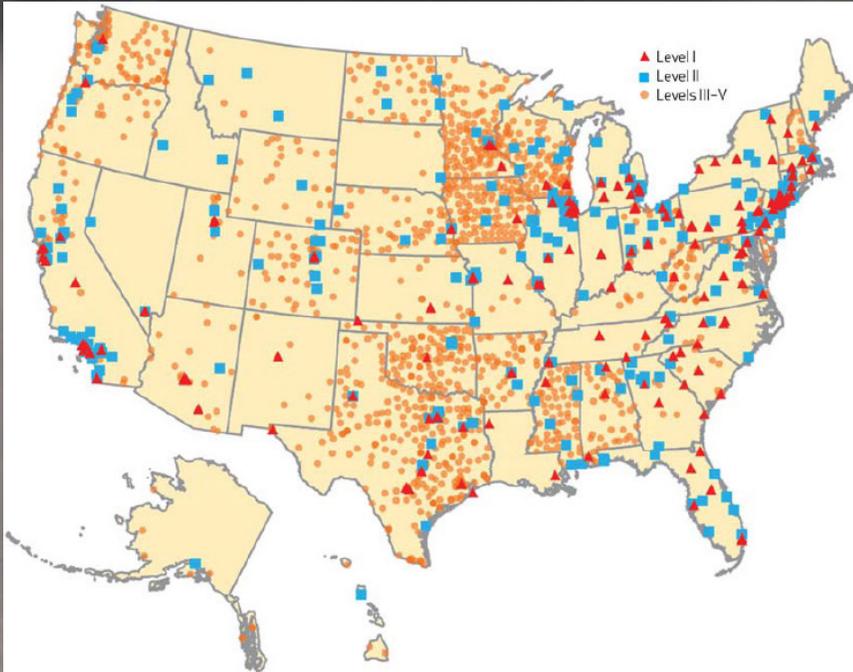
Objectification

GAP Score

RABT Score

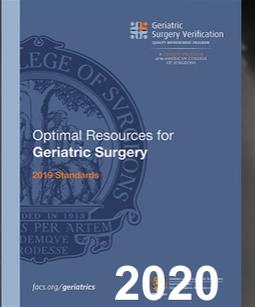


Geriatric Centers of Excellence



The American College of Surgeons Geriatric Surgery Verification Program and the Practicing Colorectal Surgeon

Meixi Ma, MD, MS, Lindsey Zhang, MD, MS, Ronnie Rosenthal, MD, MS, Emily Finlayson, MD, MS, and Marcia M. Russell, MD



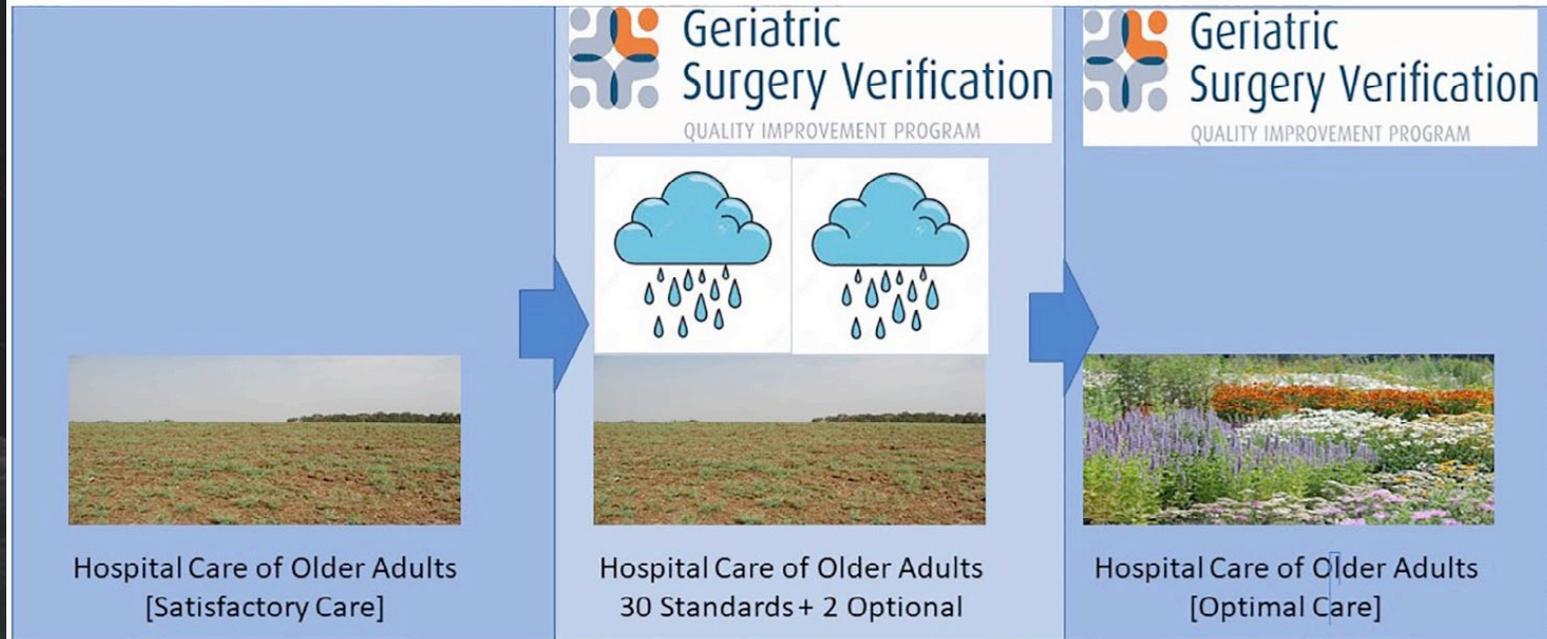
- 32 new surgical standards to improve surgical care & outcomes for geriatrics

Table 1. American College of Surgeons Geriatric Surgery Verification Program Standards (30 Mandatory, 2 Optional. Older Adults 75 Years or Older Undergoing Inpatient Surgery)

1. Administrative (e.g., letter of support, director, coordinator, quality committee, geriatric surgery nurse champion in every unit, education of nurses and providers, data collection, geriatric-friendly rooms, quality improvement project, community outreach project)
2. Goals-of-care and shared decision-making (documented and reaffirmed)
3. Phases of clinical care
 - a. Preoperative (e.g., screening for vulnerabilities, vulnerability-directed plans, communication with PCPs, discussion of life-sustaining treatments for planned ICU patients, interdisciplinary conference)
 - b. Perioperative (e.g., return of personal sensory equipment)
 - c. Postoperative (e.g., delirium screening and protocol, pain plan, mobility plan, nutrition plan, inpatient medication management, interdisciplinary postoperative care, readdressing goals of care for ICU patients)
 - d. Transitions of care (e.g., to acute care/rehabilitation centers, rescreening for vulnerabilities at time of discharge, formulating plans for follow-up, communication with PCPs)
4. Optional standards (join Geriatric Surgery ACS NSQIP Collaborative, research)

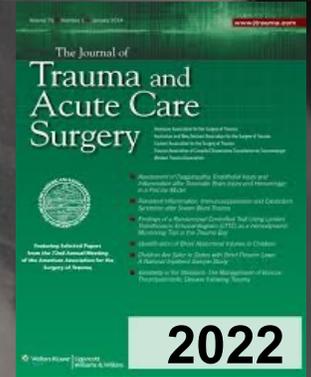
LET IT RAIN

The American College of Surgeons Geriatric Surgery Verification Program

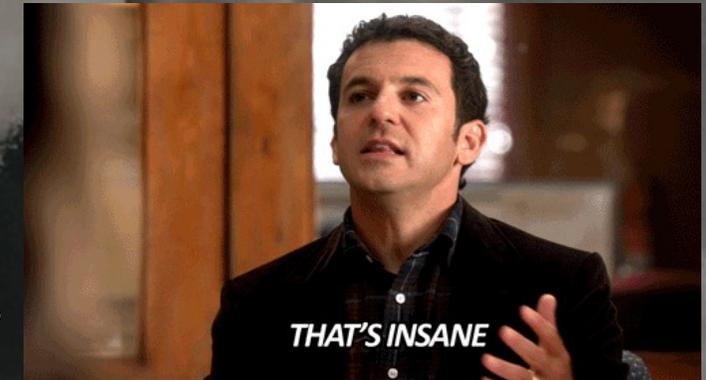


Developing a **National Trauma Research Action Plan:** Results from the geriatric research gap Delphi survey

Joseph, Bellal MD, FACS; Saljuqi, Abdul Tawab MD, DrPH; Phuong, Jimmy PhD; Shipper, Edward MD; Braverman, Maxwell A. DO; Bixby, Pamela J. MA; Price, Michelle A. PhD; Barraco, Robert D. MD, MPH; Cooper, Zara MD, MSc; Jarman, Molly PhD, MPH; Lack, William MD; Lueckel, Stephanie MD, ScM; Pivalizza, Evan MBChB, FFASA; Bulger, Eileen MD, FACS; the Geriatric Trauma Panel



- **24 experts**, 514 questions were included
- Out of 514 questions, 70% reached a consensus



More than 300 medium- and high-priority questions

It All Comes Down to This



Take-Home Points



1 Geriatric Trauma is On the Rise

2 TSFI is a Reliable Risk Stratification Tool

3 Need For Geriatric Trauma-Specific Centers/Units/Pathways

4 Objectifying Care is the Key

5 There is Much Room For Improvement



@TopKnife_B



bjoseph@arizona.edu

Thank You!